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Modern New England Gravel Plant Effects Unusual

MIXING FLEXIBILITY

By L. D. H. Anderson,
Anderson Enginering Co., Boston.

IN 1932, a new modern sand and gravel plant was built at Islington, Mass., between the towns of Norwood and Dedham, within 13 miles of the center of Boston, by the Glacier Sand and Gravel Co. The plant is on U. S. Highway No. 1, which was relocated to run through the company's property. Consequently a thought behind the design was to afford a sightly appearance rather than the all-too-frequent eye-sore. The plant is new from the ground up, including five unit type 300-ton bins for the principal storage.

This firm's business history in the gravel industry dates back about ten years, when Edward O'Toole, the owner, acquired a small area of the large deposit now held. Two parcels have since been added. Originally a small dry plant was installed to provide the material used in his contracting business, and five years ago his last dry plant was built to allow the firm to compete in a commercial way. More recently a deposit was secured about a mile from the principal bank, in order to assure an almost unlimited supply, and to augment the gravel or stone proportion.

Deposit Glacial

In this latter bank, the gravel and sand ratio is about 80:20 which makes a distinctly valuable addition to the main deposit, in which the ratio is approximately 60:40. Present plans call for operation of the main bank only. This bank is very unusual in the New England district for its height. Instead of the usual 10 to 50 ft., this one ranges from 60 to 125 ft. One of the accompanying views affords a good conception of it.

A very large proportion of the gravel is under 1 in. size, considerably reducing the amount of crushing. A further advantage is the fact that the maximum size of the gravel is only about 8 in. The whole deposit is of glacial origin with well rounded pebbles, mainly of fine texture pink and grey granite.

The sand in its natural state is exceptionally clean, with an almost complete absence of undesirable fines. Without washing, tests have always shown a strength of at least 133% of standard Ottawa sand. In past winters, which are rather severe in the district, its freedom from foreign matter has afforded gratifying results, because of the small amount of moisture retained.

These conditions were thoroughly considered by the Anderson Engineering Co., of Boston, which has worked out the details of design in very close cooperation with the owner. Equipment to process the gravel to best advantage for the market, with the lowest possible production costs was considered in all its types. One result is the production of a number of sizes not ordinarily available in gravel plants.

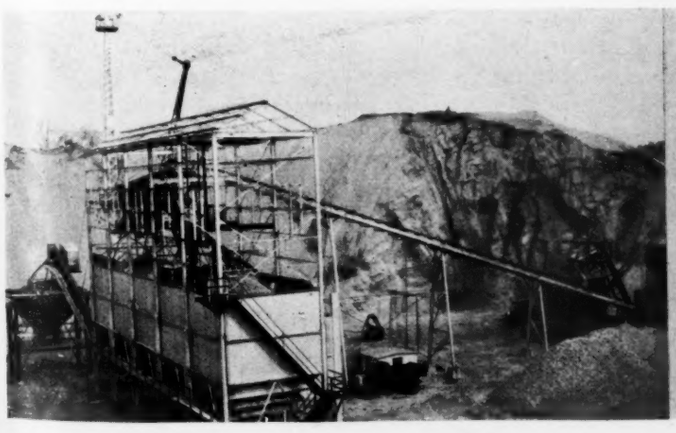
Working the Deposit

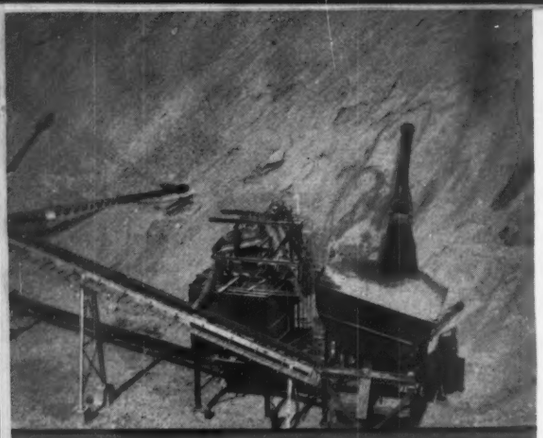
In the beginning, excavation of gravel for the new plant was done by a 1¼ cu. yd. "Lorain" 75 shovel, in order to provide room for locating a derrick and hoist house, which had been in use at the earlier plant. As soon as possible this machine was replaced with the derrick. As an auxiliary machine for handling material beyond the capacity of the derrick, a Sauerman "Crescent" scraper bucket excavator is employed.

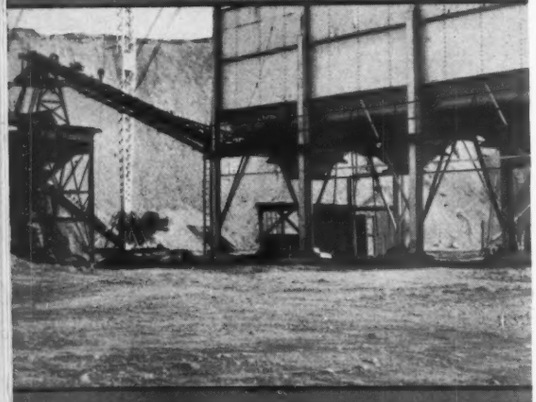
The plant is designed for wet operation, to include washing all the gravel and part of the sand if advisable. It can also be operated dry if desired—at a lower capacity of course. To take care of these conditions, the feeder of the reciprocating type has an adjustable eccentric with a range in capacity from 25 to 115 cu. yd. per hour. This feeder has its own individual drive, with a V-belt from the motor to a pair of spur gears. The motor is a 3-hp. double-deck, squirrel-cage type, affording high starting torque characteristic.

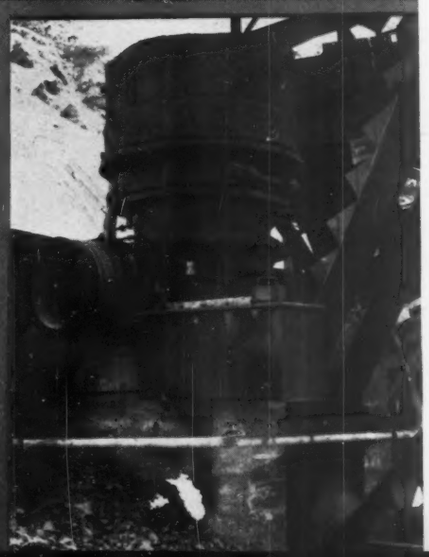
The discharge from the feeder is to a 3-ft. by 8-ft. "Telsmith" single-deck vibrat-

Plant of the Glacier Sand and Stone Co., Islington, Mass. Right-hand view shows plant from field hopper end









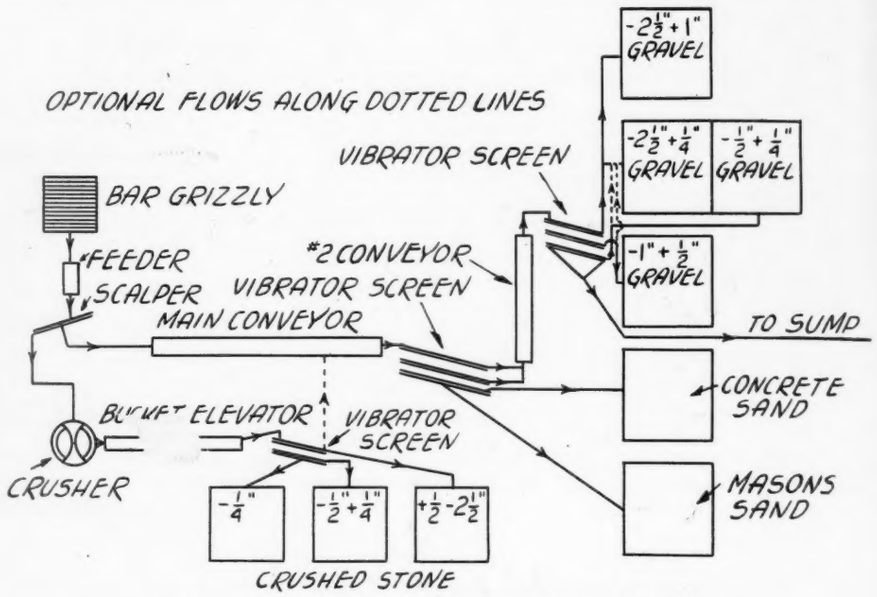
ing scalping screen, equipped with "Temperloy" wire cloth with 2½-in. clear openings. The oversize gravel goes to a No. 8-B Telsmith pillar-shaft gyratory crusher, selected because of the small amount of head room required, together with the advantage a gyratory has in keeping the production of slabby and splintered stone to a minimum. In actual operation it has been found that no closed circuit is necessary to produce 100% marketable sizes, though provision was made for this in the plant design to take care of any future market condition which may require a preponderance of very small gravel.

All material passing the cloth on the scalping screen is chuted by gravity to the main conveyor, which elevates to the main storage bins, where the discharge is to a 4-ft. by 10-ft. Telsmith triple-deck vibrating screen. This screen, like the other one on top the bins, a 3-ft. by 8-ft. Telsmith triple-deck, are employed in a very unusual manner. In each case but two decks are used for actual sizing. The third, an auxiliary deck, operates as a scalper. On the 4-ft. by 10-ft. screen the finer sizes, that is, the sand, are removed. The top deck provides the necessary protection from heavy stone to the two lower decks.

On the second screen, the lower deck separates at sand size of ¼-in. On this screen is removed all minus ¼-in. when the first screen is operated dry.

The crusher product is initially handled entirely separately. Discharge is to a No. 4 Telsmith belt and bucket elevator, which conveys to a 2-ft. by 6-ft. Telsmith double-deck vibrator, located on top a 200-ton steel bin set alongside the main conveyor. Separations are made at minus ¼-in., and plus ¼-in., minus ½-in. These sizes are taken out at these points at all times, to supply a nearby market.

All crusher product over ½-in. is either stored in the third pocket of this hopper, or chuted by gravity to the main belt conveyor. This is a Telsmith-Timken design of 164-ft. centers, which is inclined on an angle of 17-deg. 20-min. It is completely equipped with anti-friction idlers. The belt speed is at the rate of 254 ft. per min., to afford a normal operating capacity of approximately 160 tons per hour. Near the head end is a gravity take-up, which together with the lagged head pulley, assure constant belt tension and favorable driving conditions. The drive between the motor and the head shaft is through multiple V-belts and cut spur gears.



Flow sheet of the Glacier Sand and Gravel Co. plant

The main conveyor discharges to a conventional type of box chute, which breaks the fall and spreads the material for best results on the 4-ft. by 10-ft. vibrator. The top screening surface is 1-in. space cloth, which, as previously mentioned, protects the two lower screening surfaces from the heavier stone. Separations for sand are made at ⅛-in. to supply the mason and plastering trades, and ¼-in. for general concrete work. The proportions of the sand grains above and below these sizes are such as to provide almost ideal fineness moduli.

All gravel retained on the top and middle decks is re-combined on a 32-ft. centers Telsmith-Timken equipped belt conveyor and brought to the 3-ft. by 8-ft. vibrating

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Panel illustrations, top to bottom: Discharge chute, on fore side of field hopper, permits drawing off bank run gravel.

Crushed stone elevator, crusher and screen arrangement.

Conveying aggregate to weighing batcher.

Gyratory crusher of pillar shaft type, with V-belt drive. Note lubricating system with oil reservoir which requires no water for cooling. (Glacier Sand and Gravel Co. plant.)

screen, where another box type chute is used. The drive on this conveyor is of the same general type as that on the longer one. The motor is a 5-hp. double-deck squirrel cage type.

An unusual discharge chute design, employing flap-gates, affords more than ordinary distribution facilities. The plus 1-in. gravel can be sent to No. 5 pocket or to No. 4. In the latter it is combined with all the other gravel sizes to make a coarse aggregate suitable for concrete roads according to the Massachusetts Department of Public Works specifications. Plus ½-in. minus 1-in. can be kept separate in No. 3 pocket or sent to No. 4. Minus ½-in. is either stored in the auxiliary pocket alongside No. 4 or combined in pocket No. 4.

A specially designed spray nozzle, which forms a wide sheet of water, is included in the arrangement on the last mentioned screen. Nine of them are used, and are placed in such a manner as to turn over and over all the gravel, removing any fines still clinging to it. The fines and water pass all screen decks and flow to a sump.

A feature which other plants are now adopting is the precautionary measure taken in connection with lubrication. Always representing a problem with sometimes costly replacements necessary because of lack of grease, this plant is equipped with a different type of fitting for each grade of lubricant required. This is a simple and distinctly effective measure in the way it has worked out.

A point of unusual interest is in connection with the installation of the vibrator screens. Of the four employed in the plant two are supported from below and the others suspended from above. These two different methods are resorted to to afford lower installation costs. It will be seen that the two sizing screens on top could employ transverse beams in the superstructure, whereas additional expense would be involved for

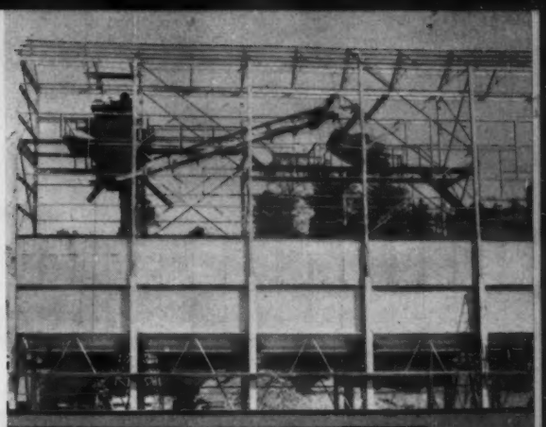
(*Concluded on next page.*)

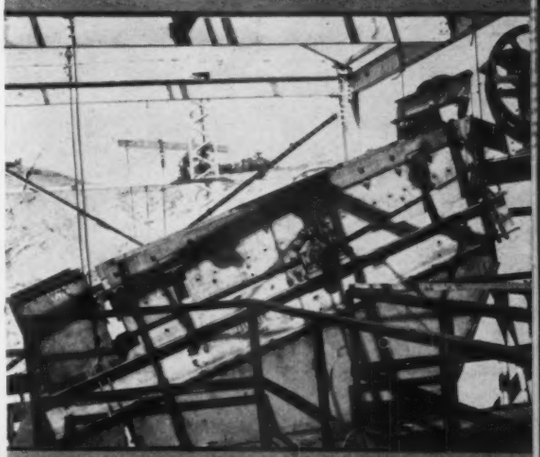
Panel illustrations, top to bottom: Walkways make every machine readily accessible. Main conveyor head pulley, 4x10 ft. screen, short conveyor and 3x8 ft. screen are shown.

Straight line layout of feeder, vibrating scalping screen and crusher.

Balanced vibrator screen, 4x10 ft.

Conveyor 2 of 32-in. centers which discharges on to 3x8 ft. triple deck sizing screen. (Glacier Sand and Gravel Co. plant.)





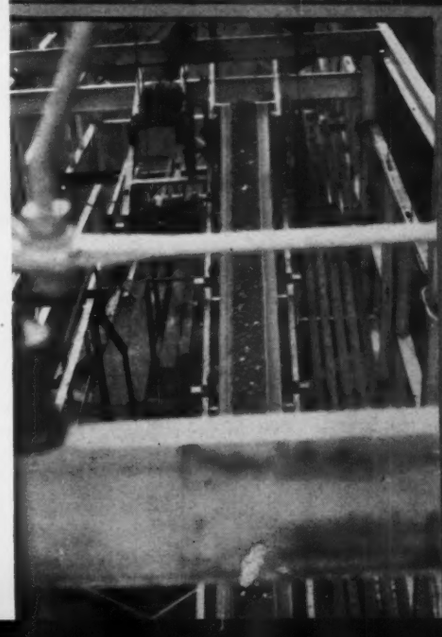


TABLE OF EQUIPMENT USED BY GLACIER SAND AND STONE CO.

OPERATION	EQUIPMENT	MAKE	MODEL NO., CAPACITY OR SIZE	POWER	DRIVE
Excavating	Derrick hoist	Insley	100 ft.	75 hp. Lincoln induction motor	Morse silent chain
	Derrick bucket	Mead-Morrison	1½ yd.		
	Crane	Lorain	75B	Waukesha gas engine WL68D	Morse silent chain
	Crane bucket	Mead-Morrison	1 yd.		
Crushing End	Feeder	Telsmith	5 ft. by 24 in.	3 hp. Fairbanks-Morse d.d. induction motor	V-belt and gear
	Scalping screen	Telsmith	3 ft. by 8 ft. single deck vibrator	3 hp. fully enclosed Louis Allis induction	V-belt
	Crusher	Telsmith	No. 8B Pillar shaft gyratory	35 hp. Westinghouse squirrel cage	V-belt
Elevating, Sizing and Washing	Stone elevator	Telsmith	No. 4 bucket on belt	10 hp. Westinghouse squirrel cage	V-rope and spur gears
	Stone screen	Telsmith	2 ft. by 6 ft. double deck balanced vibrator	3 hp. fully enclosed Louis Allis ball-bearing	V-rope
	Main belt conveyor	Telsmith-Stearns	20 in. roller bearing idlers	15 hp. Western Electric squirrel cage	V-rope and spur gears
	Sizing screen No. 1	Telsmith	Goodyear belt 4 ft. by 10 ft. three-deck balanced vibrator	7½ hp. fully enclosed Louis Allis ball-bearing	V-rope
	Conveyor No. 2	Telsmith-Stearns	20 in. roller bearing idlers	5 hp. double-deck Fairbanks-Morse squirrel cage	V-rope and gear
	Sizing screen No. 2	Telsmith	Goodyear belt 3 ft. by 8 ft. three-deck vibrator	5 hp. fully enclosed Louis Allis ball-bearing	V-belt

installing the scalping screen between the feeder and the crusher, and the 2-ft. by 6-ft. screen located on top of the screened stone bin. It is felt that the selection of the particular make of screen specified made this possible because of the positive balance obtainable with a design using opposed eccentrics, with the complete elimination of stray vibration being transferred from the screen trays to the screen frame and thence to any supporting structure.

Augmenting the facilities and products of the gravel plant are a batch hopper and "Aggremeter." The latter is fed direct from the main storage hopper by a belt conveyor located beneath it, and running its full length. Auxiliary gates were made in the underside of each storage pocket. The Aggremeter is of the weighing type, suitable for three different sizes of material. Though Massachusetts state specifications now require only two, it is felt to be only a matter of time before the third will be necessary.

The electrical installation as a whole is in accordance with the most modern practice, to include the particular features found most advantageous in a gravel plant. Protection to each machine from failure of any other to operate is afforded by an interconnected system which stops the flow up to the out-of-service unit. The equipment can only be started in a sequence contrary to the flow of material.

The control house is located below the main conveyor. Here of course are located the main switch and the remote control for each motor. Adjacent are the transformers reducing the high tension current which is supplied by the Town of Norwood. Characteristics are 220-v. 60-cycle, 3-phase.

The five steel storage units were built by the Butler Bin Co., the conveyor run by the A. O. Wilson Structural Co., along with the bin superstructure; the batch hopper and weighing Aggremeter by the Erie Steel Construction Co., and all mechanical equipment is of the Telsmith manufacture, produced by the Smith Engineering Works. Designs are by the Anderson Engineering Co., of Boston, for whom the author was supervising engineer.

Stabilization of the Aggregates Industry

By J. R. Thoenen

IN ROCK PRODUCTS of January 9, 1932, the writer presented a specific application of the Swope plan for stabilization of industry to the mineral aggregates industry. The object sought was to reduce the generalities of the Swope plan to definite concrete terms as applied to that particular industry. Admittedly, the ideas as set forth were not intended to comprise a finished product, but were offered as a starting point from which suggestion and criticism could revamp and ultimately build a plan acceptable to producers, or, on the other hand, point out the inherent weaknesses of the idea and scrap it entirely. The writer received various comments in support and in criticism of the suggested plan.

For a time following Mr. Swope's proposal interest in stabilization or "planned economy" seemed to lag, but everyone knows now that the ideas put forth by Mr. Swope and many others who were thinking along similar lines, were to bear fruit, more completely and more rapidly than probably any of us anticipated in January, 1932. Consequently the following hypothetical example of a scheme to stabilize the mineral aggregate industry, while it was developed and written more than a year ago on the basis of the Swope plan, should prove particularly interesting and helpful in working out the details of the new "National Industrial Recovery Act."

The working out of the details of application of the new law will be left largely to the individual industries, apparently. And the problem of a fair distribution of available business, in a very much over-expanded industry, will undoubtedly be one of the hardest to solve. The following thoughts are contributed to be helpful to that end.

Solution by Market Territories

Let us assume a certain market territory has a normal average annual consumption of 2,000,000 tons of mineral aggregates. This is supplied by four companies whose total productive capacity equals the normal consumption. All four companies are assumed to be well established and financed. Of these four companies let us assume that *A* has an annual capacity of 1,000,000 tons or 50% of the consumption. *B* has an annual capacity of 500,000 tons or 25% of the consumption; *C* 300,000 tons or 15%, and *D*, 200,000 tons or 10%. It is further assumed that all four companies are on an equal footing as far as quality of product is concerned.

Under the proposed stabilization plan, during a normal year the quota of each company would be identical with its capacity to produce and each plant would operate at a capacity rate to supply the market.

Now let us assume that during the second year of operation of the stabilization plan the market consumption is below normal or 1,500,000 tons, a reduction of 25%. This reduction in consumption would immediately reduce the allotted quota of each contributing company a like percentage or to the figures shown in line three of the accompanying table. It will be remembered that these tonnage allotments are under the control of the trade association and are made on the basis of the quotas agreed upon and shown in line two.

Now during this year of operation under the plan each company has handed the district office of the trade association its prices on all material sold during the year and these prices have been filed and possibly published by the association. At the end of the year it is found that company *A* has been the low bidder on 900,000 tons and company *B* on 600,000 tons, while companies *C* and *D* have been underbid on all work. Comparison of the prices with costs also filed with the association shows them to have been above production cost in each case also. These low bids are represented by percentage in the fifth line of the table. (Presumably, it could be provided that if these two companies were actually awarded contracts for 900,000 and 600,000 tons, respectively, on their low bids, they would be compelled to purchase the excess of their allotted quota from the two companies which lost out in the bidding. Were they compelled to make these purchases at the prices quoted by these two high bidders, they would be penalized by the difference in prices for the excess tonnage they bid in, but would be compensated to some extent by earning a larger allotment the following year—which looks fair.—The Editor.)

Now it becomes the duty of the district office of the trade association to compute new quotas for the competing companies for the next year's business. Referring to the last rule in the previous article, quoted as follows:

"Quotas for each succeeding year shall be based on the mean between the tonnage of its previous quota and the tonnage on which it was low bidder during the preceding year, except as may be modified by the limitations of its productive capacity."

Since the quota of company *A* the previous year was 50% and it was low bidder on 60% of the market, its quota for the next year then becomes the mean between these two figures, or 55%. Likewise company *B's* quota becomes the mean between 25 and 40%, or 32.5%. This leaves 12.5% to be split between *C* and *D*. This is split on the same

ratio as their capacities, giving *C*, 7.5%, and *D*, 5%. This reduction in market allotment to *C* and *D* is a direct result of their failure to register low bids the preceding year.

Revision of Quotas

Carrying the example further, let us assume that during the next year there is a further decline in consumption to a total of 1,200,000 tons. During the year the four companies were allotted business as it arose on the basis of their quotas as shown in line 6 of the table, resulting in tonnages sold as in line 7.

In bidding on work this year both companies *C* and *D* have registered some low bids. This may have been due to reduction of operating costs by improved methods or by reduction of profit margin. In any case it is understood their low bids, as also those of companies *A* and *B* are above their filed costs and therefore legitimate.

Tabulation of the low bids by the association shows the result in percentage in line 9 or tonnage in line 8, although actual sales were as of line 7, due to quota control.

Again computing quotas for the fourth year, company *A* will have a mean between 55% and 42% or 48.5%, company *B* a mean between 32.5% and 25% or 28.75%, company *C* a mean between 7.5% and 25% or 16.25%, and company *D* a mean between 5% and 8% or 6.5%. Note how the low bidding of company *C* during the third year has raised its quota for the next year.

Now to introduce a further variant, let us assume that during the fourth year there is a return of prosperity with an increased demand, bringing the total consumption up to 1,800,000 tons. On this basis company *B* would from its quota be entitled to 517,500 tons as shown in line 11. However, the capacity of this company was only 500,000 tons; hence it could not produce this amount.

It now becomes the task of the association to allocate this 17,500 tons excess to one of the other three competing companies or to authorize company *B* to so enlarge its plant as to produce it. Bear in mind that while it is the district office of the trade association that has this authority it is itself composed of representatives chosen by the four competing firms.

In this particular case I have assumed that company *B* was content to continue without expansion and the district office therefore allotted this excess tonnage to company *D* as being the farthest from capacity production. The adjusted tonnage for the year would then be as shown in line 13.

During this year the bidding was again competitive and the low bidders were as shown in line 15 in percentage and line 14 in tonnage.

When New Capacity Is Required

Now during the fifth year consumption has again increased till at the end of the year sales have reached a point 25% above the original capacities of the plants.

It will have been the business and duty of the district office to foresee this increase in business from its collection of market data. It will have passed this information on to its member companies and they will either have prepared to increase their capacities accordingly or allowed outside capital to enter with a new plant.

Since control of local production is in the hands of the district office of the trade association, theirs must be the decision as to how this new business can be taken care of. There are various ways this may be handled. They can allocate tonnage to each plant until their capacity is reached as in line 19, and then authorize each company to increase its productive capacity an amount equal to its quota as shown in line 16, or as represented by the sum of lines 19 and 20. Presumably one or more companies might not care to or be able to increase their capacities, in which case the association could authorize some one of the others to further increase its capacity.

In case an outside company has applied for permission to enter the field the association might award to it such additional tonnage as was not taken by the existing companies. A further possibility would be authorization of one of the four local companies as, for example, company *D* to sell to new capital with permission to increase the plant.

Further variations might be shown by continuing the example for other years in the table, but the writer feels sufficient material is given from which a picture may be obtained of the way the plan would operate.

Preventing Unneeded New Capacity

One question raised by a critic is how the association would deal with a new company attempting to force its way into the field, say in the second or third year, when consumption was below the then plant capacity. The answer is that the trade association district office has been set up under this plan for the purpose of adjusting production to consumption. It therefore must have authority to allow or prevent new production as the market requires. The procedure under the new law is for the President, or his representative, to grant licenses to producers. Then a new producer could not do business in the territory without having first obtained a license at least indirectly from the trade association.

As stated previously, the scheme advanced of course is not a final project. Doubtless there are many flaws in it. However, the writer feels that it does provide a means of controlling production to meet consumption demands without sacrificing individual competition. The annual adjustment of individual quotas on the basis of previous business and current low bids provides an incentive for the exercise of ingenuity in reduction of operating costs.

The argument may be advanced that company *A* with its much larger capacity than company *D* could at any time underbid the

Editor's Note

THE HARDEST PROBLEM to solve under the new National Industrial Recovery Act will be a fair division or proration of production among competitors in a much over-expanded industry.

It cannot be assumed that the new law requires uniform prices for materials that may have different real values for various purposes. Nor can it be assumed that the law is intended to penalize low cost, efficient producers. And certainly progress and development in quality through better or improved processing must continue to be encouraged.

The scheme proposed by our author takes these considerations into account. Where he has suggested yearly revisions of quota allotments, it might prove more desirable to revise these monthly or quarterly.

The scheme suggested retains the individuality and some independence of the producers, and it would appear works indirectly toward uniformity in prices, without compulsion.

—The Editor.

TABLE SHOWING PRORATION OF DEMAND

Plants		*A*	*B*	*C*	*D*
1	Producing capacity	1,000,000	500,000	300,000	200,000
2	Quota first year	50%	25%	15%	10%
3	Tonnage second year, 1,500,000	750,000	375,000	225,000	150,000
4	Low bid second year	900,000	600,000	.....	.....
5	Low bid per cent of total sales	60%	40%	.....	.....
6	Quota third year	55%	32.5%	7.5%	5%
7	Tonnage third year, 1,200,000	660,000	390,000	90,000	60,000
8	Low bid third year	500,000	300,000	300,000	100,000
9	Low bid per cent of total sales	42%	25%	25%	8%
10	Quota fourth year, ½ diff	48.5%	28.75%	16.25%	6.5%
11	Tonnage fourth year, 1,800,000	873,000	517,500	292,500	117,000
12	Deduct (above capacity) and add to low		17,500		17,500
13	Adjusted tonnage	873,000	500,000	292,500	134,500
14	Low bid	1,000,000	400,000	300,000	100,000
15	Low bid per cent of total sales	56%	22%	17%	5%
16	Quota fifth year, ½ diff	52.25%	25.4%	16.6%	5.75%
17	Tonnage fifth year, 2,500,000	1,400,000	635,000	315,000	150,000
18	+ or —	—400,000	—135,000	—15,000	+50,000
19		1,000,000	500,000	300,000	200,000
20		261,000	127,000	83,000	29,000

latter. From the writer's experience in studying costs at both large and small plants throughout the country this does not necessarily follow. While it may be true and many times is true that an increased tonnage in any one plant automatically reduces production costs in that particular plant, yet a smaller competitor because of natural advantages or by greater ingenuity may be able to produce a smaller tonnage at a cost below that of the larger operator. For one thing, his initial capital input may be considerably less, resulting in a lower overhead charge, and since from the operation of the plan all costs are to be compiled on the same basis his ultimate cost may be less for this reason alone.

Competition Between Aggregates

No attempt has been made to indicate how the control of production should be handled as between two kinds of aggregates that compete in the same markets. It would seem that this is a matter that could be left to the specification requirements of the consumers. It then becomes a matter of study by the separate associations or of a general committee of all and education of the consumer as to the particular merits of the competitive products. The consumer is the ultimate judge in any case and it remains with the producer or his association to sell him on the merits of his product.

Chance for New Methods

Another question that has arisen is, what will be done with the new producer desirous of entering the field with an *entirely new and unique method* of operation for which he claims substantial reduction in operating costs. The argument is advanced that the operating association being jealous of its members and satisfied with existing conditions could have him denied a license to operate during a time of subnormal consumption. Is he to be prohibited from demonstrating what his process will do? Not at all. He must have a perfect right to so demonstrate, else there would be a woeful lack of new processes, or progress.

Suppose this new producer is allowed to bid on local work as he begins to produce, and let us assume his bids are lower than those of member companies and yet above his cost figures. In other words, let us assume he demonstrates in six months that his process is cheaper. He then is allowed a quota on the basis of his previous low bids. The tonnage he secures in this manner as his quota must be subtracted prorata from the already existing companies. Thereafter his business increases or decreases in accordance as he is low or high bidder.

If at the end of a probationary period his process has not achieved his claim for low cost and he cannot by legitimate low bids take business from established concerns, the trade association may, through the President, order him to abandon the operation.

Forcing him to quit after a failure would tend to cause the new producer to scrutinize his process with exceeding care before launching it. On the other hand, it should not deter the man with a legitimately new or progressive idea, for he is assured of a market or his earned portion of it immediately he demonstrates his ability to produce efficiently.

The established concerns, on the other hand, are assured of not more than the probationary period of disturbance of their market, if the process is a failure. Of course, if it succeeds they must give way before it, as they must eventually under the inexorable law of progress.

Scheme Proposed for Grouping of Competitive Stone Producers

Mutual Sales Organization Proposed with Establishment of Maximum Prices and Competitive Bidding

W. R. FRANCE, president of the American Stone Corp., Lima, Ohio, has circularized crushed-stone producers of western Ohio with a proposition which contains the following suggestions for the formation of a mutual selling organization:

I. Corporate Form

(A) *Capital Stock.*

(1) *Preferred stock* (10,000 shares, $10 par value) has no voting power but receives all distributable earnings.

(2) *Common stock* (500 shares, no par) is limited to one share for each concern (including subsidiaries, etc.) regardless of size.

(3) *Purchase of stock.*

The number of preferred shares available to each stone company might be fairly determined by a per cent of the *amount in dollars* (tons multiplied by price equals amount in question) for which an option could safely and legally be given by the stone company to the proposed corporation covering crushed stone delivered at the quarry *as called for* during the ensuing three-year period.

The *total quantity,* price *below an established maximum quarry price,* and *rate of delivery as to quantity and size* should be fixed every third month by the stone company and, provided the original amount in dollars remains unchanged, same might be varied by such company to balance production, etc.

Upon payment of cash equal to 1% of said *amount in dollars,* the preferred stock at $10 per share, together with one share of common stock (price, gratis) would be issued to the stone company for one-half the payment, the other half being applied to the paid up Surplus Account.

II. Stone Prices

(A) *A base price* should be determined periodically from the main elements of cost in some such manner as follows (Note: These are explanatory figures):

(1) Labor—½ man hour per ton @ 30c..... .15

(2) Dynamite—¼-lb. per ton @ 12c per lb..... .03

(3) Power—2 kw. per ton @ 3c ..... .06

(4) The sum is multiplied by the constant figure "2". .24 x 2 = $0.48

(5) Base price should then be the multiple of 10 nearest resulting figure as $0.50

(B) *Maximum quarry price* referred to above might then be established at

1. Base price for Group 1 (No. 1, 2, 3, 34 and 7). (Sizes of crushed stone specified in Ohio state highway specifications.)

2. Base plus 10c for Group 2 (No. 4, 4C, 4X and 46).

3. Base plus 20c for Group 3 (No. 6, 9 and concrete sand).

(C) *Established sales price* for the sales corporation should then be automatically set by adding 10c per ton to the *maximum quarry price.*

Centralizing Promotional and Credit Activities

III. The Purpose of the Proposed Sales Corporation is to:

(A) Maintain the selling price as determined above by the costs.

(B) Relieve member companies of all expense incidental to advertising, promoting and selling.

(C) Eliminate bad accounts and questionable contractors through a Credit Department that handles the trade references, does the billing and is responsible for the collections.

(D) Secure strict observance of terms.

(E) Build a standard system of truck deliveries under a Trucking Division that would be subject to a transportation manager.

(F) Insist upon a uniform system of freight rates on crushed stone through a Traffic or Railroad Division of a Transportation Department.

(G) Support a Technical Department that would hold in check the specifications of theoretical engineers, architects, etc., and place crushed stone at its true value in relation to other materials.

(H) Bring about lower prices for blasting and other supplies through quantity buying. The actual prices paid by the member

companies should be based on a sliding scale for quantity consumption.

(I) Effect an interchange of equipment among members for the purpose of placing their idle investment to work.

(J) Organize a Division of Certified Accountants that would regularly audit books of the various corporations, townships, counties, state highway departments, and thus

(1) Correct improper purchases.

(2) Uncover graft and favoritism.

(3) Furnish and analyze actual costs of operating government-owned equipment, such as trucks, etc.

Competitive Bidding

IV. The Operation of the Proposed Sales Organization should be governed by a set of regulations and thus reduce the "actual management" to handling the great amount of detail involved.

(A) From the want of competition, the sales work becomes a matter of order-taking, trouble-shooting, goodwill promotion and auditing of public accounts.

(B) All orders received for crushed stone must be submitted to all members for BIDS and the LOWEST BID *always* gets the business.

(C) In event no bids are received from the member companies, the option referred to under Purchase of Stock shall be exercised and the low price applicable to the work must furnish the material.

(D) The member companies shall be invited to bid for the privilege of meeting, under their own name, competition expected from an outside company since the established price of the sales corporation must be strictly maintained at all times.

V. Earnings and Dividends

(A) The "bidding feature" of the proposed sales corporation will bring about an accumulation of earnings which will be distributed to the member companies through their preferred stock holdings.

(B) The earnings of those quarries which cannot be operated at the prices bid will have an income as well as the owners of the operating plants.

(C) When the demand for crushed stone is limited, the more efficient plants would automatically carry the load and the increased earnings of the sales corporation that should naturally result from close bidding would bring about an increase in dividends to the *non-operating members.*

(D) With a heavy demand for crushed stone, the bid price would be high and the earnings of the sales corporation would be low, but practically all the member quarries would be operating at a profit within themselves.

VI. Member Companies

(A) Membership in the sales corporation governs the territory covered and would be limited only by the ability of the organization to handle the necessary details.

(B) Every member should be left free to withdraw at any time and lose by the action only the cash advanced for the preferred stock.

(C) However, the option given to the sales corporation for furnishing crushed stone shall remain in effect until automatically released by the surrender of both the preferred and common stock held by it in the sales corporation.

(D) Any unauthorized quotation and/or sale by a member company is equivalent to a withdrawal and the unpaid dividends or earnings shall be retained by the sales corporation as "liquidated damages" and shall be credited to the Profit Account for future distribution.

Advantages

VII. The advantages of such a corporation in addition to maintaining an established sales price might be listed as follows:

(A) Contractors and others would no longer be in position to use one stone company against another in the purchasing of crushed stone.

(B) Financial risks in the form of irresponsible contractors, etc., will be eliminated.

(C) A more substantial division of funds [illegible] concrete highways and other construction could then be insisted upon.

(D) The per cent of highway funds now being absorbed by bituminous products would [illegible]y reduced for the reason that the higher priced stone would eliminate bituminous construction in many instances.

(E) With the sales price as established, new quarries could not be opened on the margin of profit figured.

(F) Those inefficient plants that could not exist at the sales price would eventually cease to operate but instead of a total loss, as would result under present conditions, the owner would be compensated to the extent of his dividends.

(G) Eventually the equipment of the obsolete plants would be either

(1) Taken over by the sales corporation,

(2) Purchased piece by piece by member companies,

(3) Installed at a new location.

Research Work of the National Crushed Stone Association

Reviewed by Edmund Shaw

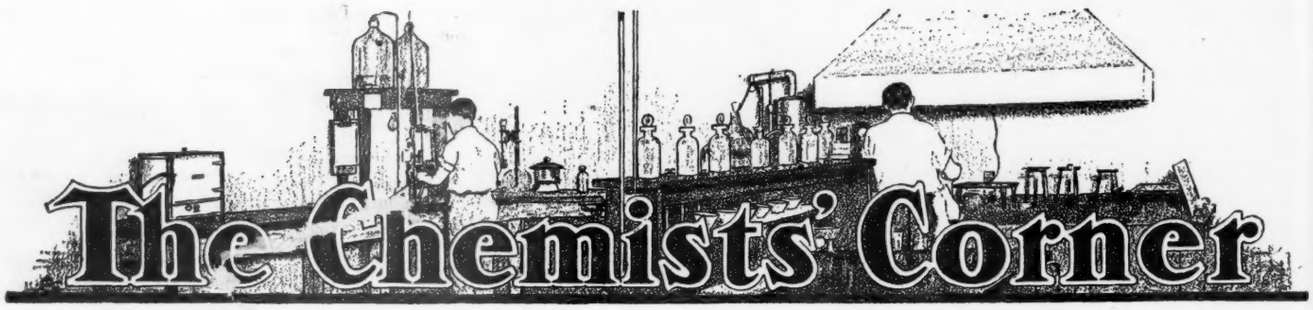
AT THE recent Detroit convention A. T. Goldbeck gave an excellent summary of the work of the engineering bureau of the association, which work began with the organization of the bureau in 1925. At that time there was a belief that crushed stone concrete was deficient in workability. The bureau's first paper, on the bulking of sand, showed that, on account of bulking, concrete proportioned by volume was undersanded, and this more seriously affected crushed stone concrete because of the greater voids in crushed stone. Today practically all specifications recognize the principles enunciated in this paper and crushed stone concrete is more workable than formerly.

A second paper of great importance was on the water-cement ratio method of proportioning concrete. This paper showed that there are a number of such relations as the water-cement ratio, depending on the kind of aggregate used. This paper apparently opened the eyes of engineers and architects, and many specifications have been changed to apply to particular aggregates.

The New Jersey tests were urged on that state by the bureau, and the U. S. Bureau of Public Roads cooperated with the New Jersey state highway department in the investigation that followed. These tests established that the quality of the coarse aggregate made a great difference in the beam strength of concrete, and trap rock was no longer penalized by requiring more cement per cubic yard. These tests and others made by the bureau showed conclusively the importance of designing highway concrete according to the beam strength, and field results have borne out the bureau's conclusions. No one can say to what extent the researches of this bureau affected engineering opinion, but it is significant that 27 states now use the beam test as the basis of concrete highway design, and crushed stone producers now sell their product in fairer competition than when highway concrete was proportioned by volumes arbitrarily chosen.

Bituminous highways have not been neglected and the bulletin of the bureau on "Retreading Our Highways" has been of great assistance in promoting this type of paving. Laboratory researches have covered a wide field. Two which have served to remove ill-founded prejudices are those relating to flat and elongated particles and to the effect of stone dust on strength and durability. Tests of gravel ballast have shown *quantitatively* the greater stability of angular materials. Stone sand grading has been studied and explained to producers, and the soundness test for aggregates has been so exhaustively studied that it is now possibe to show positively the fallacies of the sodium sulphate test, which has often rejected really sound aggregates.

In the future it is certain that much of the highway building will be of the lighter and less expensive types, and the bureau is ready to aid the producer in the special and general problems presented. So, too, with cement bound macadam, which will open a considerable market for crushed stone.



Effect of Composition of Portland Cement on Length and Weight Changes of Mortars*

Tricalcium Silicate Has Least Effect on Shrinkage; Tricalcium Aluminate the Most

By Hubert Woods, Howard R. Starke, Harold H. Steinour
Riverside Cement Co., Riverside, Calif.

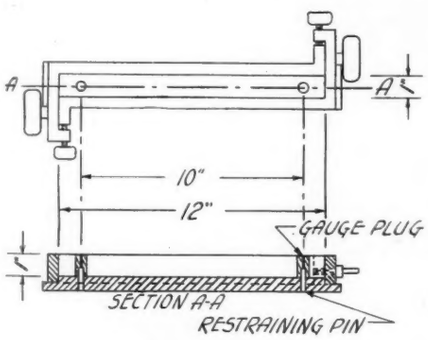
INTRODUCTION: This paper deals with the changes in length and weight of mortar bars made using three parts of sand and one part by weight of portland cements of varied composition.

The cements used in this investigation have been described previously.[1]

The work here reported is part of an investigation of the volume changes of hardening portland cement, and had for its object the determination of the relative orders of magnitude of the effects of the four major cement compounds on that volume change.

Experimental Methods

The mortar bars used in this investigation were 1 in. in cross section and 12 in. in length, with two metal gauge points imbedded at 10-in. centers. These bars were cast in molds as shown by the accompanying drawing.



Mold for bars

1. Molding and Curing of Specimens—Mortars were prepared by thoroughly mixing one part of cement with three parts of dry plaster sand and then gauging with water to the amount of six-tenths (0.6) by weight of the cement. After two minutes mixing, the mortar was placed in a wax-paper-lined mold and pushed into place by pressure of the thumbs. After passing over the material twice with the thumbs, the surplus mortar was struck off by use of a trowel. The mortar bars were allowed to harden in the molds and in contact with water-saturated air at approximately 70 deg. F. for from 20 to 24 hours, after which the bars were removed from the molds and initial measurements made.

The bars were placed on end in boxes and separated by spacers that facilitated free air circulation around each bar. By placing the bars on end, warping was prevented.

During the first three weeks, the bars were cured in water saturated air at approximately 70 deg. F., after which they were exposed to the unaltered air of the laboratory.

2. Measurement of Length and Weight—A Whittemore strain gauge fitted with a Federal dial scaled to one ten-thousandth of an inch was used to indicate the separation of the small reference holes in the gauge plugs embedded in the specimens.

Length and weight measurements were made simultaneously at frequent intervals.

Due to limitations of time and equipment only three specimens could be molded per day. As a result, each group of specimens was started on its curing schedule at a different date. The curing schedule included a period of exposure to atmospheric air. Since atmospheric conditions are variable, the curing during this period was different for each group of specimens. As a possible means for

TABLE 1—TEST DATA ON VARIOUS CEMENTS USED

Cement No.	Fineness: as 200-mesh screen per cent passing	Fineness: as sq. cms. per gram	Gypsum	Clinker analysis: SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Clinker compounds—calculated, per cent: 4CaO Al_2O_3 Fe_2O_3	3CaO Al_2O_3	2CaO SiO_2	3CaO SiO_2
2122.....	99.9	1390	3.23	27.68	3.76	1.98	2.48	64.97	6.0	6.6	59.7	26.0
2123.....	99.5	1450	3.23	25.96	3.48	5.06	2.32	63.15	15.4	0.7	52.4	29.2
2092.....	99.9	1470	3.23	21.86	5.75	2.77	5.04	65.02	8.4	10.6	20.4	56 0
2088.....	99.8	1480	3 23	24.60	5.85	2.80	2.40	64.18	8.5	10.8	47.1	31.0
2096.....	99.9	1500	3.23	25.04	3.86	2.11	2.36	66.57	6.4	6.7	32.7	51 8
2085.....	99.9	1530	3.23	22.52	6.17	2.85	2.43	66.47	8.7	11.5	22.2	55.5
2086.....	...	....	4.31	22.32	6.17	2 85	2.43	66.47	8.7	11.5	22.2	55.5
2087.....	...	....	3.23*	22.32	6.17	2.85	2.43	66.47	8.7	11.5	22.2	55.5
2094.....	99.9	1560	3.23	20.93	4.64	5.74	2.08	66.26	17.5	2.6	6.2	71.3
2124.....	99.8	1570	3.23	23.54	4.83	7 21	2.24	62.03	21.9	0.6	44 2	30.9
2089.....	99.9	1580	3.23	21.96	4.65	6.06	2.32	64.07	18.4	2.1	22.2	54.0
2093†.....	99.9	1600	6.46	21.44	8.81	1.19	2.48	66.64	3.6	21.3	25.7	47.5
2125.....	...	1620	3.23	22.48	5.00	7.46	2.24	62.72	22.7	0.6	34.1	40.2
2095.....	99.9	1630	3.23	21.34	6.07	2.93	2.56	67.03	8.9	11.1	11.6	65.7
2091.....	99.9	1670	3.23	21.94	5.57	2.68	2.44	67.71	8 2	10.2	11.8	67.7

*Added as gypsum and converted to plaster of paris by heating at a maximum temperature of 150 deg. C. after milling (determined by loss of weight).
†Quick-set.

The amount of free lime in the clinkers was zero in all cases but one, in which case (No. 2095) the amount was 0.03%, a negligible quantity.

*Submitted to the editor, January 18, 1933.

References

[1]Woods, Steinour, Starke, "Effect of Composition on Heat Evolved During Hardening," *Industrial and Engineering Chemistry*, Vol. 24, page 1207, November, 1932.

[2]Bogue, "Calculation of the Compounds in Portland Cements," *Industrial and Engineering Chemistry*, Analytical Edition, I. 192 (1929).

TABLE II—DATA LENGTH CHANGES OF 1:3 CEMENT MORTAR BARS

Total length change at 10-in. centers in inches
Expansion (+) Contraction (—)

Cement No.	Group 1			Group 2		Group 3			Group 4		
	2085	2086	S–16	2087	S–19	2088	2089	S–22	2091	2092	S–25
2 Days	—.00015	—.00035	.0000	—.00035	—.0001	—.00075	+.00035	—.00015	—.00025	—.00045	—.00005
3 Days	—.00055	—.00065	.0000	—.0005	—.00005	—.0008	—.0003	—.0001	—.00055	—.0006	—.0001
7 Days	—.0010	—.00105	—.0001	—.00085	—.00015	—.0012	—.0004	—.0001			
8 Days									—.00075	—.00095	+.00005
14 Days	—.00095	—.00095	+.0002	—.0009	+.0001	—.0015	—.00045	+.00015			
15 Days									—.00065	—.0008	+.0004
21 Days	—.00095	—.0010	+.00035	—.00085	+.0003	—.0015	—.00045	+.00025	—.0007	—.00075	+.00045
22 Days	—.00495	—.00455	—.00375	—.00455	—.00395	—.0055	—.0035	—.00405	—.0033	—.0034	—.0023
23 Days	—.0065	—.00605	—.0051	—.00625	—.00555	—.0075	—.0050	—.0053	—.0051	—.0050	—.00405
24 Days	—.00755	—.00705	—.0061	—.00685	—.00615	—.0084	—.0055	—.0058			
25 Days											
27 Days									—.0069	—.0070	—.00645
28 Days	—.00665	—.00665	—.0062	—.00625	—.00595	—.00805	—.0052	—.00805	—.069	—.0070	—.00655
35 Days	—.0073	—.00735	—.0071	—.00725	—.00725	—.0097	—.0070	—.00795	—.00715	—.00715	—.0074
42 Days	—.0072	—.0073	—.0071	—.00715	—.00735	—.00905	—.00635	—.00745	—.0075	—.00745	—.0079
49 Days	—.0068	—.00685	—.0068	—.0073	—.0074	—.01005	—.0074	—.00745	—.00965	—.0097	—.0100
56 Days	—.0085	—.00855	—.0085	—.0092	—.00935	—.01155	—.0086	—.0[illegible]	—.0098	—.00985	—.01045
63 Days	—.00945	—.00955	—.0096	—.00945	—.00975	—.0113	—.0083	—.00935	—.0[illegible]25	—.00935	—.0101
70 Days	—.00875	—.0089	—.0090	—.00885	—.0093	—.0113	—.0083	—.0099	—.0[illegible]	—.00935	—.01015
84 Days	—.00865	—.0087	—.0089	—.00915	—.00955	—.0114	—.00835	—.00995	—.0105	—.01035	—.0112
105 Days	—.0090	—.00905	—.0091	—.00905	—.0094	—.0114	—.0083	—.00985	—.0093	—.0093	—.0101
126 Days	—.0092	—.0093	—.0093	—.00915	—.0095	—.0117	—.0085	—.00995	—.010[illegible]	—.0104	—.01125
156 Days	—.0094	—.00945	—.0095	—.0094	—.00985	—.0121	—.0089	—.01035	—.0099	—.0099	—.0109
186 Days	—.0106	—.01075	—.01065	—.01065	—.01105	—.01325	—.0100	—.01155	—.0095	—.0099	—.0109
216 Days	—.01045	—.01055	—.0105	—.01035	—.01085	—.0132	—.0099	—.01135	—.0102	—.0102	—.0111
246 Days	—.0096	—.00965	—.0098	—.00955	—.01005	—.01275	—.0093	—.01065	—.01105	—.01105	—.01205
276 Days	—.0094	—.0095	—.0096	—.00935	—.0099	—.01255	—.00905	—.01045	—.00975	—.00985	—.0108
306 Days	—.0100	—.01015	—.0102	—.0100	—.01055	—.01315	—.00965	—.01105	—.01065	—.0107	—.0117
340 Days	—.0106	—.01065	—.0107	—.0104	—.01095	—.0137	—.01005	—.0115	—.01035	—.0111	—.0120
370 Days	—.0107	—.0108	—.01085	—.01055	—.01115	—.01395	—.01035	—.01175	—.0111	—.0112	—.0122
400 Days	—.01105	—.01115	—.0112	—.0109	—.01145	—.0142	—.0106	—.01195	—.0111	—.01145	—.0123
430 Days	—.01105	—.0112	—.01125	—.01105	—.0116	—.0144	—.01075	—.0121	—.01145	—.01165	—.01255
460 Days	—.0114	—.01155	—.0116	—.01125	—.01185	—.01475	—.0110	—.0124	—.01185	—.0120	—.01285
490 Days	—.0112	—.01135	—.01145	—.0111	—.01175	—.01465	—.0109	—.01225	—.01155	—.01175	—.01275
520 Days	—.01055	—.0107	—.01085	—.0104	—.0111	—.0141	—.01035	—.01165	—.0109	—.01115	—.01215

correction of this difference, each group of specimens included a mortar bar made in each case using the same normal commercial portland cement.

A temperature correction was made by use of a mild steel bar which has a thermal expansion approximately that of an average commercial cement mortar.

Experimental Data

Table I presents the cement finenesses, the amounts of gypsum in the cements, the clinker analyses, and the calculated amounts of the compounds in the clinkers. The latter calculations were made according to the method of Bogue.[2]

Due to the method of preparation, all of these cements gave less residue on the 200-mesh screen than is generally the case with commercial cements of the same specific surface. The surface values correspond to good commercial practice.

The total change in separation of the metal gauge plugs, embedded in the mortar bars on 10-in. centers, at a number of ages is shown in Table II. The standard bars are indicated by the prefix "S" to the number. Expansion is indicated by a plus sign and contraction by a negative sign.

Table III shows the total weight change of the bars at a number of ages. The weight change is that of a 1x1x12-in. bar or of 12 cu. in. of mortar (less the volume occupied by two gauge plugs of ½-in. diameter).

For the purposes of indicating the influence of specimen size, a 4x4x48-in. bar was cast. Table IV shows the length change occurring between four sets of gauge points located on 10-in. centers in this bar and also the length change of a small bar of the same cement cast at the same time as the large bar.

Precision of Data

The precision of the data will be largely discussed during the analysis of the data.

The determinations of specific surface of the cements are considered to be reproducible to about plus or minus 1.5%. The data indicate that the variation in specific surface of the cements has been a disturbing factor of no greater an order of magnitude than others occurring in the investigation.

The uniformity of the procedure employed in molding specimens was tested a number of times by molding duplicate bars which could be similarly cured. These tests show prac-

TABLE II—(Continued)

Total length change at 10-in. centers in inches
Expansion (+) Contraction (—)

Cement No.	Group 5			Group 6			Group 7			Group 8		
	2094	2095	S–29	2093	2096	S–32	2122	2123	S–41	2124	2125	S–44
2 Days	—.00035	—.00025	+.00015	—.0005	+.00005	+.0001						
3 Days	—.00035	—.00045	+.0002	—.0009	.0000	+.0001						
7 Days				—.0008	—.00005	+.0003	.0000	+.00035	+.00005	—.0004	.0000	.0000
8 Days	—.00035	—.00085	+.00035									
14 Days	—.00055	—.00085	+.0005	—.00085	—.00005	+.0005	—.00015	+.0003	+.00025	—.0004	.00005	+.0002
15 Days												
21 Days	—.0005	—.0007	+.0007	—.00085	—.00005	+.0006	—.0003	.0000	+.0002	—.00055	—.0001	+.0001
22 Days	—.00275	—.00435	—.0024	—.00305	—.0014	—.0012						
23 Days	—.00355	—.0051	—.00345	—.0046	—.00245	—.0016						
24 Days				—.0057	—.0035	—.0034	—.0032	—.0025	—.00355			
25 Days	—.0042	—.0052	—.0042									
27 Days							—.0049	—.0032	—.00455			
28 Days	—.0055	—.0064	—.0058	—.00825	—.0058	—.0059	—.0058		—.00465	—.00455	—.00445	—.00475
35 Days	—.0065	—.00705	—.00705	—.01145	—.0083	—.0088	—.00855	—.0067	—.00775	—.0073	—.0074	—.0072
42 Days	—.0083	—.0094	—.00925	—.0114	—.00815	—.0091	—.00995	—.0078	—.00965	—.00865	—.00895	—.0093
49 Days	—.00855	—.00955	—.0101	—.0113	—.0081	—.00925	—.00945	—.0073	—.00945	—.0081	—.00845	—.00905
56 Days	—.00715	—.00895	—.00975	—.0113	—.0081	—.00925	—.0105	—.0082	—.01075	—.0090	—.00945	—.0103
63 Days	—.00815	—.00895	—.00985	—.0115	—.0082	—.0094	—.0094	—.0074	—.00905	—.00805	—.0083	—.00865
70 Days	—.00825	—.00915	—.00995	—.01215	—.00875	—.00995	—.0095	—.00765	—.00885	—.00825	—.0083	—.00855
84 Days	—.0085	—.00945	—.0102	—.01145	—.00815	—.0093	—.0105	—.0089	—.01025	—.0093	—.00915	—.00995
105 Days	—.00955	—.0107	—.01145	—.0117	—.0084	—.0094	—.0113	—.0097	—.0110	—.00985	—.0100	—.0107
126 Days	—.00845	—.00955	—.01035	—.01295	—.0091	—.01035	—.0117	—.0102	—.01165	—.01025	—.0104	—.01125
156 Days	—.00865	—.00965	—.01055	—.0139	—.00995	—.0111	—.0124	—.01085	—.01185	—.01085	—.01085	—.0116
186 Days	—.00865	—.00965	—.01055	—.0139	—.0098	—.0109	—.0124	—.0109	—.0117	—.01085	—.0108	—.0113
216 Days	—.00965	—.0108	—.0116	—.0128	—.00895	—.0100	—.01315	—.0116	—.0124	—.0115	—.01155	—.0121
246 Days	—.00885	—.00995	—.01085	—.0145	—.01015	—.01125	—.01365	—.01205	—.01275	—.01195	—.0120	—.01255
276 Days	—.00865	—.00955	—.0106	—.0137	—.0097	—.0107	—.0137	—.0120	—.0127	—.01205	—.01195	—.01245
306 Days	—.0095	—.0105	—.01145	—.0148	—.01055	—.0116	—.01325	—.0115	—.01215	—.01155	—.01145	—.0118
340 Days	—.0104	—.01155	—.0124	—.0141	—.0099	—.0109	—.0139	—.0122	—.0130	—.0122	—.0122	—.0128
370 Days	—.0100	—.01105	—.0120	—.01455	—.0104	—.0113	—.0145	—.0128	—.0136	—.0127	—.0128	—.0135
400 Days	—.01015	—.01115	—.01215	—.0155	—.01115	—.01205	—.01435	—.0126	—.0135	—.01255	—.0127	—.0134
430 Days	—.01035	—.0114	—.0121	—.0155	—.0112	—.0121						
460 Days	—.01015	—.0111	—.01215	—.0152	—.0109	—.0118						
490 Days	—.01025	—.01125	—.01225	—.01505	—.0107	—.01165						
520 Days	—.0099	—.01085	—.0119	—.0146	—.01035	—.0113						

tically exact agreement. The measurement of length is duplicable to within one ten-thousandth of an inch in ten inches. The weight was determined to the nearest one-tenth gram.

Analysis of Data

Fig. 1 shows the change in the length and weight of a test bar, containing cement No. 2093 at various ages, including 490 days, during its exposure to atmospheric air. Since all of the bars behave similarly, we may, for the purpose of the following discussion, assume that this plot typifies all of the pertinent data.

Upon inspection of Fig. 1, the two following observations are to be made.

(1) There is a large and rapid decrease in weight and a similar shrinkage in length of the bar during the first two weeks of its exposure to atmospheric air.

(2) After the initial period of large and rapid change there is considerable fluctuation during short periods of time in the weight decrease and in the shrinkage of the bar. This is evidenced by the reversals in slope of the curves.

The large and rapid decrease is the adjustment to the relatively dry air of the laboratory after a period of exposure to water saturated air. The subsequent fluctuations are adjustments to the changing conditions of the atmospheric air.

At the time of measurements, it was evident that weather disturbances were always productive of fluctuations in the measurements of the bars. The bars always increased in weight and length during rainstorms or foggy weather and then decreased when these weather disturbances passed.

This correlation with the humidity was so pronounced as to be scarcely mistakable. As no correlation could be found between the temperature and changes in the bars, the relationship with the humidity is evidently a causal one. Other atmospheric variables are probably not very significant.

During the first few days exposure of the bars to the relatively dry atmospheric air, the decrease in weight must have been largely loss of water. The accompanying shrinkage in length must have been due, at least in part, to that loss of water.

Further data are presented in Fig. 2 where the length changes in a bar of 1-in. cross-section and 12-in. length are compared to those in a bar of 4-in. cross-section and 48-

TABLE III—DATA ON WEIGHT CHANGES OF 1:3 CEMENT MORTAR BARS

Total weight change of 11.6 cu. in. of mortar in grams

Gain (+) Loss (—)

	Group 1			Group 2		Group 3			Group 4		
Cement No.	2085	2086	S–16	2087	S–19	2088	2089	S–22	2091	2092	S–25
2 Days	— 1.7	— 1.4	— 0.9	— 1.1	— 1.1	— 1.0	— 1.1	— 0.4	— 1.6	— 1.9	— 0.9
3 Days	— 2.6	— 2.2	— 1.6	— 1.9	— 2.3	— 1.7	— 1.7	— 0.8	— 2.0	— 2.8	— 1.4
7 Days	— 2.9	— 2.1	— 1.9	— 1.5	— 2.7	— 2.8	— 2.1	— 0.3			
8 Days									— 1.1	— 2.7	— 0.8
14 Days	— 2.2	— 1.3	— 0.7	— 0.9	— 1.5	— 3.0	— 1.2	+ 0.8			
15 Days									— 0.4	— 2.3	+ 0.4
21 Days	— 2.0	— 1.1	— 0.4	— 0.7	— 1.1	— 3.1	— 1.0	+ 0.8	— 0.1	— 2.1	+ 0.8
22 Days				— 9.3	— 9.1	—16.8	—11.3	— 7.3	— 4.1	— 7.7	— 5.2
24 Days	—10.9	—10.8	—10.0	—11.7	—11.5	—19.2	—13.3	— 9.1	— 6.8	—10.6	— 8.1
24 Days	—11.9	—12.0	—11.4	—12.6	—12.5	—20.1	—14.1	—10.0			
25 Days									— 9.2	—13.3	—11.5
27 Days									— 9.5	—13.5	—12.0
28 Days	—11.8	—12.1	—12.2	—12.5	—13.0	—19.8	—13.8	—10.2	— 9.8	—13.6	—12.8
35 Days	—11.7	—12.2	—12.3	—13.0	—13.6	—20.7	—14.9	—11.5	— 9.7	—13.6	—12.7
42 Days	—11.4	—12.0	—12.0	—12.9	—13.5	—20.2	—14.4	—11.2	—11.4	—15.2	—14.9
49 Days	—10.8	—11.4	—11.6	—12.6	—13.1	—20.4	—14.6	—11.4	—12.6	—16.3	—16.4
56 Days	—11.6	—12.2	—12.4	—13.9	—14.6	—21.9	—16.7	—13.5	—12.7	—16.3	—16.4
63 Days	—12.7	—13.6	—13.9	—14.8	—15.8	—21.8	—17.0	—13.9	—12.7	—16.2	—16.3
70 Days	—12.5	—13.5	—13.9	—14.7	—15.7	—21.6	—17.2	—14.0	—13.4	—16.8	—16.9
84 Days	—12.1	—13.1	—13.5	—14.7	—15.7	—21.4	—17.0	—13.9	—12.6	—15.9	—15.9
105 Days	—12.1	—13.3	—13.4	—14.6	—15.5	—20.8	—16.6	—13.6	—13.2	—16.4	—16.3
126 Days	—12.0	—13.1	—13.1	—14.6	—15.2	—20.2	—16.3	—13.4	—12.8	—15.7	—15.5
156 Days	—11.5	—12.7	—12.5	—14.4	—14.8	—19.6	—15.9	—13.1	—12.5	—15.4	—15.0
186 Days	—11.9	—13.1	—12.8	—14.9	—15.2	—19.6	—16.1	—13.5	—12.3	—15.0	—14.6
216 Days	—11.3	—12.5	—12.1	—14.3	—14.5	—18.6	—15.4	—12.8	—12.1	—14.6	—14.4
246 Days	—10.1	—11.3	—10.8	—13.1	—13.2	—17.2	—14.0	—11.6	—11.1	—13.4	—13.1
276 Days	— 9.5	—10.8	—10.1	—12.6	—12.5	—16.2	—13.1	—10.9	—10.8	—13.2	—12.8
306 Days	— 9.5	—10.7	—10.0	—12.5	—12.5	—15.9	—12.9	—10.8	—11.1	—13.4	—13.1
340 Days	— 9.6	—10.9	—10.1	—12.8	—12.5	—15.7	—12.9	—10.9	—11.4	—13.6	—13.2
370 Days	— 9.2	—10.5	— 9.6	—12.3	—12.1	—15.0	—12.4	—10.4	—11.1	—13.1	—12.7
400 Days	— 9.4	—10.6	— 9.8	—12.5	—12.2	—14.9	—12.4	—10.6	—10.8	—12.9	—12.4
430 Days	— 9.0	—10.2	— 9.3	—12.2	—11.8	—14.4	—11.9	—10.1	—10.9	—12.9	—12.4
460 Days	— 8.9	—10.1	— 9.2	—12.1	—11.7	—14.1	—11.7	—10.0	—10.9	—12.8	—12.3
490 Days	— 8.7	— 9.9	— 8.8	—11.8	—11.3	—13.7	—11.3	— 9.6	—10.6	—12.5	—11.9
520 Days	— 7.8	— 8.9	— 7.8	—10.9	—10.3	—12.7	—10.3	— 8.6	— 9.7	—11.5	—10.9

TABLE III—(Continued)

Total weight change of 11.6 cu. in. of mortar in grams

Gain (+) Loss (—)

	Group 5			Group 6			Group 7			Group 8		
Cement No.	2094	2095	S–29	2093	2096	S–32	2122	2123	S–41	2124	2125	S–44
2 Days	— 1.5	— 1.8	— 0.8	— 1.2	— 1.4	+ 0.1						
3 Days	— 2.3	— 2.9	— 1.5	— 1.6	— 2.2	— 0.5						
7 Days				— 0.9	— 2.0	— 0.0	— 2.4	— 3.2	— 0.3	0.0	— 1.2	— 1.1
8 Days	+ 0.2	— 2.0	— 0.9									
14 Days	0.0	— 1.3	— 0.1	— 0.4	— 0.7	+ 1.0	— 5.5	— 8.1	+ 0.1	+ 0.2	— 1.3	+ 0.1
15 Days												
21 Days	+ 0.1	— 1.0	0.0	— 0.1	— 0.2	+ 1.7	— 5.4	— 9.3	+ 0.9	+ 0.1	— 1.3	+ 0.6
22 Days	— 6.1	— 6.1	— 6.6	— 5.3	— 4.3	— 3.2						
23 Days	— 8.0	— 7.6	— 8.3	— 8.2	— 6.7	— 5.5						
24 Days				— 9.7	— 8.1	— 6.7	—18.1	—22.1	— 6.2	—16.8	—14.0	— 5.1
25 Days	— 9.2	— 8.4	— 9.5									
27 Days							—19.7	—23.1	— 7.5	—20.0	—16.5	— 6.7
28 Days	—11.0	— 9.7	—11.4	—13.0	—11.3	—10.2	—20.4	—23.6	— 8.3	—21.0	—17.6	— 7.6
35 Days	—11.4	—10.0	—12.1	—16.7	—15.1	—14.9	—23.3	—25.8	—11.5	—23.8	—20.7	—11.0
42 Days	—14.1	—12.1	—15.0	—17.2	—15.7	—15.8	—25.0	—27.1	—14.2	—25.5	—22.9	—13.8
49 Days	—16.0	—13.5	—17.0	—17.2	—16.0	—16.2	—24.2	—26.3	—14.0	—24.8	—22.4	—13.7
56 Days	—16.2	—13.6	—17.1	—17.0	—15.9	—16.1	—25.1	—26.9	—15.2	—25.7	—23.4	—14.9
63 Days	—16.2	—13.6	—17.1	—17.2	—15.9	—16.1	—23.1	—25.2	—13.7	—23.8	—21.7	—13.4
70 Days	—16.2	—13.7	—17.1	—17.9	—16.4	—16.6	—22.1	—24.2	—13.0	—22.8	—20.8	—12.6
84 Days	—16.6	—14.0	—17.3	—17.0	—15.6	—15.8	—22.2	—24.3	—13.6	—23.1	—21.3	—13.3
105 Days	—16.9	—14.4	—17.6	—16.9	—15.3	—15.6	—21.6	—23.6	—14.1	—22.6	—21.4	—13.8
126 Days	—16.0	—13.8	—16.7	—17.3	—15.5	—15.8	—21.7	—23.5	—14.9	—22.7	—22.0	—14.7
156 Days	—15.5	—13.4	—16.1	—16.8	—15.0	—15.4	—20.5	—22.3	—14.6	—21.5	—21.0	—14.3
186 Days	—15.3	—13.3	—15.9	—16.4	—14.4	—14.9	—19.3	—21.3	—14.1	—20.5	—20.0	—13.7
216 Days	—15.2	—13.4	—15.9	—15.1	—13.1	—13.6	—19.1	—21.0	—14.3	—20.4	—20.1	—14.0
246 Days	—14.0	—12.3	—14.6	—15.6	—13.4	—14.0	—18.4	—20.5	—14.1	—19.8	—19.6	—13.7
276 Days	—13.0	—11.4	—13.6	—14.3	—12.1	—12.8	—17.9	—20.0	—13.6	—19.2	—18.9	—13.3
306 Days	—13.2	—11.7	—13.9	—14.9	—12.4	—13.2	—16.4	—18.7	—12.4	—17.8	—17.5	—12.0
340 Days	—14.2	—12.8	—14.7	—14.2	—11.7	—12.5	—16.6	—19.0	—12.9	—18.0	—17.8	—12.5
370 Days	—12.9	—11.5	—13.6	—13.9	—11.3	—12.3	—16.7	—19.2	—12.7	—18.2	—17.7	—12.5
400 Days	—12.9	—11.5	—13.4	—14.1	—11.4	—12.4	—16.5	—19.1	—12.3	—17.9	—17.2	—12.0
430 Days	—12.7	—11.4	—13.2	—13.7	—11.0	—12.0						
460 Days	—12.3	—11.0	—12.9	—13.3	—10.5	—11.5						
490 Days	—12.1	—11.0	—12.6	—13.0	—10.3	—11.3						
520 Days	—11.5	—10.3	—12.0	—12.3	— 9.6	—10.7						

in. length. It is observed that the larger bar is slower to respond to the change from water saturated to relatively dry air and that it is less subject to irregular changes. This result is in accord with the previous discussion.

In anticipation of the disturbing effect of weather changes, as previously stated, the test bars were molded in groups of three; one of which was a standard bar that was duplicated in each group.

In Fig. 3 the shrinkage of a number of bars expressed as a percentage of the shrinkage of the corresponding standard bar (hereafter referred to as shrinkage rating) is shown in most cases at ages up to and including 490 days. The period of exposure to water saturated air is not shown because the length change was small and the consequent error in the shrinkage rating correspondingly large. This method of presentation shows quantitatively, at any age, the relative standing of the various bars in point of shrinkage. By comparing Fig. 1 showing directly the observed data, and Fig. 3 showing shrinkage ratings it is evident that:

(1) The fluctuations or irregularities in the observed data caused by variation in atmospheric air humidity are not so evident when the data are presented as in Fig. 3. This indicates that for a given variation in atmospheric air humidity, the test bars tend to show a percentage change in their total shrinkage approximately equal to that of the standard bars. It follows that for a given change in atmospheric air humidity, all of the bars would have practically equal percentage changes in their shrinkage.

2. The curves on Fig. 3 show that, after the first 80 days to at least one year, there is only a small change in the shrinkage ratings of the various bars. It is evident that an analysis based upon the shrinkage rating of each bar at any time after the first 80 days will be good, for most practical purposes, at any time in the period from 80 days to one year.

During the initial exposure of the bars to atmospheric air, all values, in general, decrease, indicating that the shrinkage of the standard bar is increasing at a greater percentage rate than is that of the test bars which are compared with it. This phenomenon is due entirely to the nature of the cement used in the standard bar and is a circumstance that could have been completely reversed by the selection of another cement.

The difference in the shrinkage between test bars at any age must be largely due to difference in the chemical constitution of the cement used. A least square analysis of the shrinkage ratings at 276 days indicated the following ratings of each of the four major chemical compounds in portland cement. The shrinkage rating of the normal commercial portland cement used as a standard in this work is taken as equal to 1.0. The analysis considered only the four major chemical compounds in clinker, consequently the effect of other compounds present in the clinker and of gypsum in the cement is absorbed in the values placed on the major compounds.

TABLE IV—COMPARISON OF LENGTH CHANGES OF LARGE AND SMALL BARS

Total length change at 10-in. centers in inches
Expansion (+) Contraction (—)

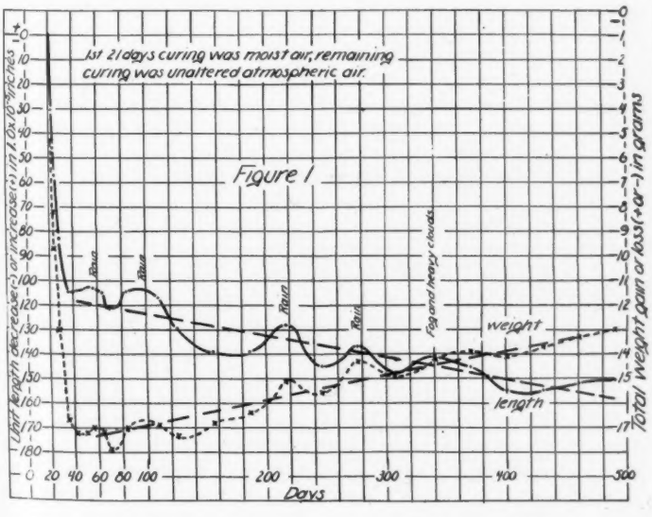
Measurement Points	Large bar 1	2	3	4	Small bar
2 Days	—.00005	—.00015	—.0001	.0000	.0000
3 Days	—.00005	—.0002	—.00015	.0000	.0000
7 Days	—.0007	—.0008	—.0008	—.0006	—.0001
14 Days	—.0004	—.0008	—.00065	—.00065	.0002
21 Days	—.00055	—.00075	—.00075	—.00045	.00035
22 Days	—.0020	—.0022	—.00215	—.0019	—.00375
23 Days	—.0026	—.0026	—.0026	—.00235	—.0051
24 Days	—.00325	—.00325	—.00325	—.0029	—.0061
28 Days	—.0041	—.00405	—.00405	—.0036	—.0062
35 Days	—.00535	—.00535	—.0054	—.0049	—.0071
42 Days	—.0062	—.00625	—.00625	—.00575	—.0071
49 Days	—.0066	—.00665	—.0067	—.0061	—.0068
56 Days	—.0077	—.0080	—.0081	—.00745	—.0085
63 Days	—.00895	—.00915	—.00925	—.0086	—.0096
70 Days	—.00925	—.0094	—.0095	—.00875	—.0090
84 Days	—.00955	—.00965	—.0098	—.0090	—.0089
105 Days	—.0103	—.01035	—.0105	—.0097	—.0091
126 Days	—.01065	—.01075	—.01095	—.0101	—.0093
156 Days	—.0108	—.01085	—.0110	—.0104	—.0095
186 Days					—.01065
216 Days	—.0117	—.01175	—.0119	—.0114	—.0105
246 Days	—.01085	—.0109	—.0111	—.01075	—.0098
276 Days	—.0110	—.0110	—.01125	—.0109	—.0096
306 Days	—.01115	—.01115	—.01145	—.0110	—.0102
340 Days	—.01195	—.01195	—.01215	—.01185	—.0107
370 Days	—.0116	—.01165	—.0119	—.0115	—.01085
400 Days	—.01205	—.01205	—.0122	—.0119	—.0112
430 Days	—.0121	—.01205	—.01225	—.01	—.01125
460 Days	—.01235	—.01235	—.0126	—.01215	—.0116
490 Days	—.0121	—.01215	—.0123	—.01195	—.01145
520 Days	—.0113	—.0113	—.01145	—.01105	—.01085

	Shrinkage ratings
Tricalcium silicate	0.46
Dicalcium silicate	1.06
Tetracalcium alumino ferrite	1.68
Tricalcium aluminate	3.22

Only those twelve cements having the same amount and kind of retarder w[illegible] used in this analysis.

The least square analysis was applied to the shrinkage ratings, as previously [illegible]fined, rather than to the actually observed shrinkages, for the following reasons: Shrinkage ratings are less subject to the disturbing influence of changing air humidity and are probably less affected by changes in curing conditions; moreover they are more nearly constant during comparatively long time intervals. They are more convenient values, affording a ready visualization of the advantage of one cement or cement compound over another cement or cement compound.

In Fig. 4 is shown the actual shrinkage ratings of the bars plotted against similar values calculated from the compound con-



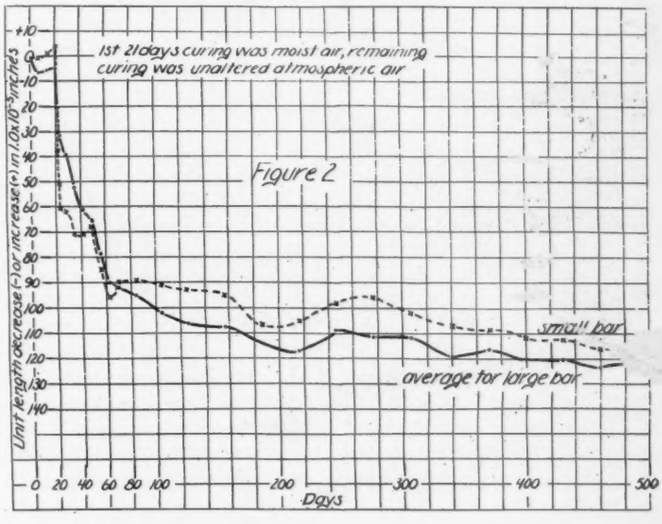
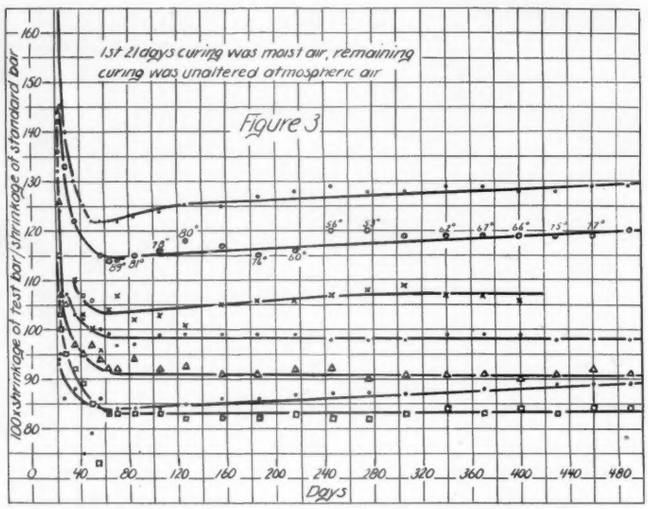

1st 21 days curing was moist air, remaining curing was unaltered atmospheric air
Figure 2
small bar
average for large bar
Days

Fig. 1 shows varying length and weight of typical test bar over 490-day period. Fig. 2 charts similar variations of small bar compared with those of large bar

stitution of the cement clinkers from which the cements used were ground. The calculated values, in some cases, are considerably at variance with the observed values. This is to be expected because of possible error in the measurement of length and the chemical analyses of the clinkers. The shrinkage ratings of the chemical compounds, above presented, were determined from measurements of but twelve test bars and cannot be considered to be of high accuracy. It was found necessary to make the least square analysis since no relationship was apparent upon inspection of the data.


1st 21 days curing was moist air, remaining curing was unaltered atmospheric air
Figure 3
100 x Shrinkage of test bar / Shrinkage of standard bar
Days

Shrinkage data in Fig. 3 show that after from 80 days to at least a year there is only a small change in shrinkage ratings of various bars

Fig. 1 shows that after the bar has made the adjustment from exposure to water saturated air to that of atmospheric air, the shrinkage continues with a trend that is linear with time up to at least fourteen months. In comparing these trends, the data were corrected with respect to the standard bar as a common base of reference by subtracting the slope of the standard bar from that of the corresponding test bar. In Fig. 5, it is shown that these slopes increase with increase in the dicalcium silicate plus tetracalcium alumino ferrite content of clinker. When the observed data, uncorrected, is plotted similarly to Fig. 5, the curve will extrapolate to zero shrinkage for zero content of dicalcium silicate plus tetracalcium alumino ferrite in clinker. From this it would appear that the continued shrinkage after 80 days is produced, for the most part, by but two of the chemical compounds in portland cement. This effect is no doubt due to continued chemical activity of these compounds which causes an increase in the shrinkage producible by unit content, making it impossible to give the compounds a general shrinkage rating which is as applicable at one age as another. Because of this change with time, the shrinkage ratings previously presented are strictly true only at the age at which the data were analyzed. This change with time is, however, not large compared to the total shrinkage, so practically, the shrinkage ratings are approximately correct for a considerable period of time. The small effect of the change in the ratings with time is shown in Fig. 3 by the small relative change in the position of the curves with time.

This effect of dicalcium silicate might be logically anticipated since it is the compound most active at the later ages. It is very interesting to observe that the shrinkage produced by dicalcium silicate plus tetracalcium alumino ferrite continues to be linear with respect to time over a period of at least four hundred days (see Fig. 1).

Fig. 6 presents the weight decrease data in the same way that Fig. 3 presents the shrinkage data.

By analyzing cross-sections of all the data presented as in Fig. 6 it is found that the weight decrease ratings (ordinates of Fig. 6), at any age between 80 and 400 days, become smaller linearly as the tricalcium silicate plus tricalcium aluminate content of the clinker increases. Such an analysis is shown by Fig. 7 at 84 and 400 days. From Fig. 6 it is seen that the weight decrease ratings tend to converge with the passing of time. This converging tendency is shown on Fig. 7 by a turning motion of the curves tending to make them become horizontal.

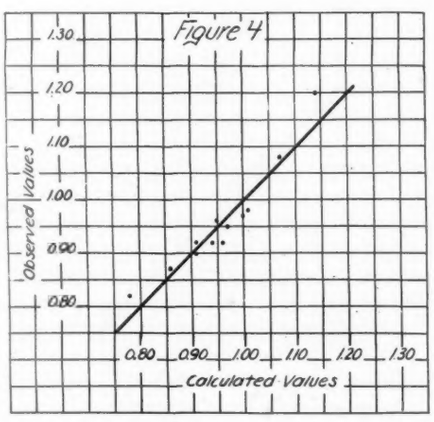


Fig. 4 plots shrinkage ratings of bars against similar values calculated from cement compositions used

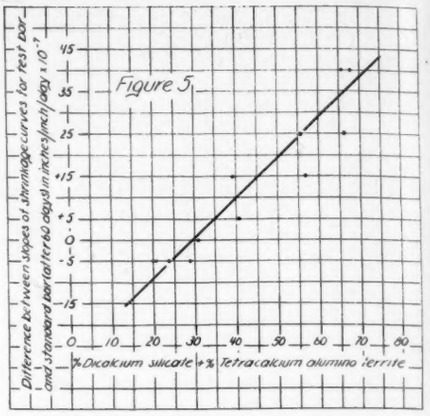


Figure 5
Difference between slopes of shrinkage curves for test bar and standard bar after 80 days in inches/inch/log x 10⁻⁶
% Dicalcium silicate + % Tetracalcium alumino ferrite

Fig. 5 indicates continued shrinkage after 80 days is caused principally by the two cement chemical compounds noted

The changes with time that are observed in Figs. 6 and 7 were first observed on Fig. 1, which shows that after the bars have made the adjustment from exposure to water-saturated air to that of atmospheric air, the weight starts to return toward its original value with a trend that is linear with time up to at least fifteen months. Differences between bars in the rate at which weight is regained cause the curves of Fig. 6 to converge and those of Fig. 7 to approach the horizontal with time.

In analyzing the slopes of the weight decrease curves after 80 days (that is, the rates at which weight is regained) the data were corrected with respect to the standard bar as a common base of reference by subtracting the slope of the standard bar from that of the corresponding test bar. Fig. 8 shows that the rate at which weight is regained increases linearly with increase in the dicalcium silicate plus tetracalcium alumino ferrite content of clinker.

The influence of the several chemical compounds on the weight decrease might be explained as follows:

The two tricalcium compounds are those that react rapidly with water, consequently an increase in their percentage would be expected to decrease the quantity of water that is free to be lost to the air at the early ages. At the later ages, dicalcium silicate becomes chemically active, drawing the water of the bar into closer chemical union, necessitating absorption of water from the atmosphere in order that equilibrium water vapor pressure be maintained.

The weight effects at the early ages are presumably due primarily to the tricalcium compounds, the changes at the later ages are probably produced primarily by the dicalcium silicate plus tetracalcium alumino ferrite compounds, and the effects at the later ages may be accounted for by combinations of the influence of the four compounds.

No direct measurements were made toward determination of the thermal coefficient of expansion of the various bars; however, the data does lend itself to a discussion of this property.

Returning to Fig. 3 it will be recalled that the length decrease at various ages of some of the bars is there presented as a percentage of the length decrease of the corresponding standard bar. The air temperature varied considerably from one time of length measurement to another and so, in the event of the existence of an appreciable difference in the thermal coefficient of the bars, irregularities should appear in the data presented on Fig. 3.

Air temperatures at the time of measurement of length of that bar showing the greatest irregularity are shown in Fig. 3.

It is evident that no correlation between temperature and irregularity exists, which indicates that the differences in thermal coefficients of the various bars are small. The absolute magnitude of the variation from the curve of that point marked as 56 deg. is only 3.5×10^{-5} in. per inch.

In considering the application of the results of this investigation to commercial cements it must be realized that the behavior of commercial cements is in part determined by such factors as fineness, uncombined lime, etc., the effects of which are not indicated by this investigation. Further, the behavior of a cement under any condition of use cannot be accurately predicted from tests of the same cement under another condition of use.

The results of this investigation, therefore, are not offered as means for the prediction of the volume and weight change of hardening cement used under any condition. But for the conditions under which they were determined, they indicate the relative contribution of each of the four major chemical compounds to the volume and weight change of hardening portland cement.

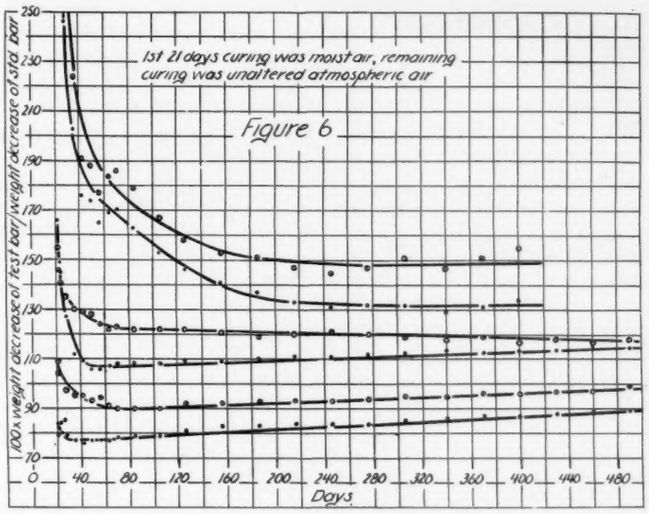

1st 21 days curing was moist air, remaining curing was unaltered atmospheric air
Figure 6
100x weight decrease of test bar/weight decrease of std bar
Days

Fig. 6 presents weight-decrease data indicating small changes after 80 days

Summary

The length and weight changes of 1 to 3 plaster sand mortar bars, made using portland cements of various chemical compositions, were determined at various ages, in some cases up to 520 days. The following conclusions are indicated, applying to the conditions under which the data were obtained.

(1) Change in the humidity of the atmosphere to which mortar bars are exposed appreciably affects their length and weight. Increase and decrease in humidity is respectively accompanied by increase and decrease in the length and weight of the bars (see Fig. 1.).

(2) A given change in atmospheric air humidity causes all of the bars examined to have practically equal percentage change in their shrinkage (see Fig. 3).

(3) At 276 days, the shrinkage ratings of the bars can be calculated by consideration of only the four major chemical compounds; their shrinkage ratings being as follows (a shrinkage rating of 1.0 corresponds to that of the standard bars, containing a normal commercial portland cement):

	Shrinkage ratings
Tricalcium silicate ($3CaO.SiO_2$)	0.46
Dicalcium silicate ($2CaO.SiO_2$)	1.06
Tetracalcium alumino ferrite ($4CaO.Al_2O_3.Fe_2O_3$)	1.68
Tricalcium aluminate ($3CaO.Al_2O_3$)	3.22

4. After the bars have made the adjustment from water saturated air to atmospheric air, the bars continue to shrink linearly with respect to time for at least 320 days (see Fig. 1.) This additional shrinkage after 80 days increases linearly with increase in the dicalcium silicate plus tetracalcium alumino ferrite content of clinker (see Fig. 5).

This additional shrinkage is small compared to the total shrinkage, effecting but small change in the shrinkage ratings of the bars over a period of at least 320 days (see Fig. 3).

5. At any time during the period from 80 days to at least 400 days, the relative total weight decrease of the bars is largely determined by the tricalcium silicate plus tricalcium aluminate content of the clinker. The weight decrease increases linearly with decrease in the content of the two tricalcium compounds (see Fig. 7).

6. After the bars have made the adjustment from water saturated air to atmospheric air, the bars begin to regain weight linearly with respect to time for at least 320 days (see Fig. 1). The rate at which weight is regained increases linearly with increase in the dicalcium silicate plus tetracalcium alumino ferrite content of clinker (see Fig. 8).

The weight regained is appreciable (see Fig. 1) effecting a decrease with time in the predominating influence of the two tricalcium compounds (see Fig. 7) and effecting a considerable change with time in the relative weight ratings of the various bars (see Fig. 6).

7. Differences in the thermal coefficients of expansion of the bars are indicated as being small.

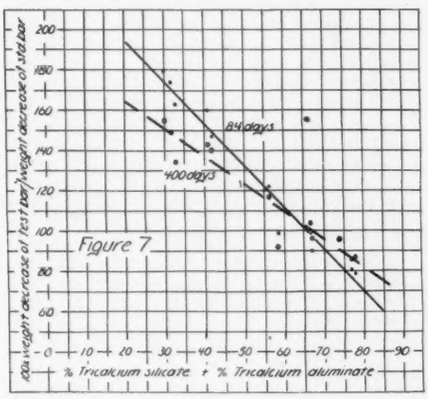

84 days
400 days
Figure 7
100x weight decrease of test bar/weight decrease of std bar
% Tricalcium silicate + % Tricalcium aluminate

Fig. 7 marks the trend of weight-regaining of bars toward the linear trend of time

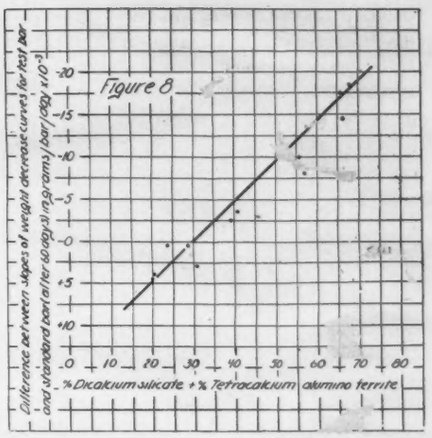


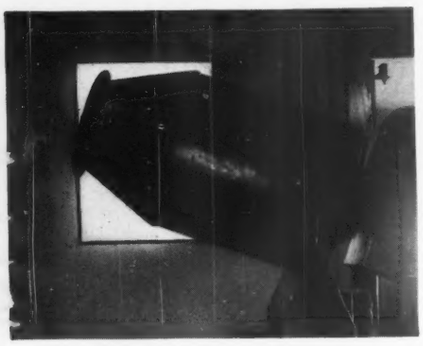
Figure 8
Difference between slopes of weight decrease curves for test bar and standard bar (after 80 days) in grams/bar/day x 10⁻³
% Dicalcium silicate + % Tetracalcium alumino ferrite

Fig. 8 shows influence of the two chemical compounds noted on rate of weight regaining

Hints and Helps for Superintendents

Selling Ready Mixed Concrete

GRAHAM Brothers, Inc., Long Beach, Calif., has built a small model of a Transit mixer which rests on a table in its main office. This model, while not an exact reproduction of the Transit system, is sufficiently reproduced that one can readily see the principle used. The device was built to use for sales training, but is now also used



Model mixer has display value

to demonstrate to buyers of ready mixed concrete.

On entering the office one cannot help but notice the device. This causes many to ask its purpose, so that in essence it acts as a display advertisement.

The device as shown in the illustration is simply a mixing drum shaped similar to the Transit mixer. The whole is mounted on a central support so it can be tilted and discharged. A small electric motor drives the mixer. It has a capacity of 50 lb. of concrete.

Removing Excess Pea Gravel

By W. G. Spicer
Manager Spicer Gravel Co., Marseilles, Ill.

"WITH only three bins (two for sand), we faced the problem of taking out some pea gravel and rinsing our gravel as it came out of the bin to make it pass state specifications. Another bin and a new screen seemed the only way out. But these, especially the bin, were not practical in connection with the layout of the old bins. Then, too, there was the matter of the investment to be taken into consideration.

"A spout 10 ft. long and 10 in. wide was constructed. Near one end, and for the full width, a 4 ft. perforated plate with ½-in. round holes was placed. This was fastened on the gravel chute resting the lower end on the base of a conveyor. This makes a long spout about 16 ft. which runs at a 45 deg. angle. The upper end is about 12 ft. high and the lower 2 ft.

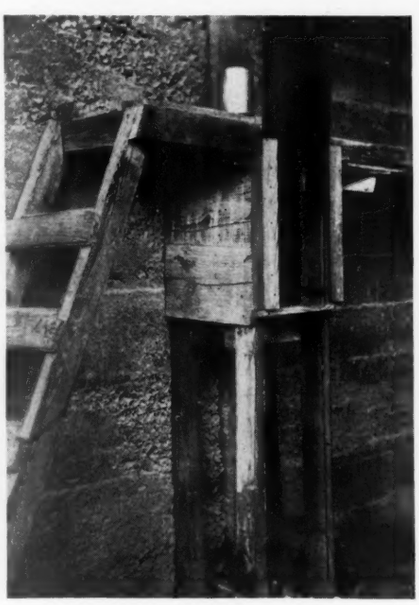
"Water was piped to the head end of the gravel chute and a truck is placed under the perforated plate when gravel is taken out. The water comes through into the truck bringing the clay and some pea gravel (the amount can be regulated by a piece of tin used as a blind). The pea gravel, of which there is about 4 cu. yd. to every 30 cu. yd. of coarse material going up the conveyor, is readily salable as top dressing for roads and drives.

"The conveyor takes the material either to a small batching bin or stock pile. Segregation caused by stock piling with a conveyor can be eliminated by using a swivel spout on the end of the conveyor."

Drinking Water for the Hot Days

THE accompanying illustration shows the way one quarry company helps to keep its employes satisfied and on the job during the hottest of the summer days.

Water is frequently a very scarce article around crushing plants. At this plant the framework and box shown in the picture were put up on the ground floor of the plant in the coolest spot available and a wooden keg, fitted with a spigot, was installed in the box. Ice in the keg keeps the temperature down and the water palatable. A sliding door was placed over the front of the box.



Reservoir for drinking water

This has helped to make the ice last through the hottest days.

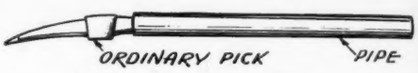
With this little keg a good supply of drinking water is available for the men at all times and costs the company only a few cents a day. Probably the beneficial effect on the morale could be reckoned in dollars every day instead of the few cents which it costs.

A Handy Digging Kink

By W. F. Schaphorst
Newark, N. J.

ROCK PRODUCTS workers are often called upon to dig in "impossible places."

Here is a handy kink: When there isn't room enough to swing a pick comfortably,



Pick adapted to corner work

remove the head and slip it into a pipe as indicated, and your man is ready to go ahead. He can get into almost any corner with a pick of this kind.

Wasting 50 Tons of Sand Per Hour

THE Durbin, Calif., sand and gravel plant of the Consolidated Rock Products Co. has an interesting and difficult problem in disposing of approximately 50 tons per hour of excess waste sand. The method adopted is described by Harry D. Jumper, engineer of the company, in U. S. Bureau of Mines I. C. 6607 as follows:

Due to the surplus of sand, it is necessary to waste approximately 20%, or 50 tons per hour, which was originally accomplished by a flume 2 ft. wide by 2 ft. deep, lined with ¼-in. steel plate, and carried on timber bents. This flume with an elevation at the sand drags of about 40 ft. above the ground and an 8% grade, discharged into a large pit about 300 ft. west of the plant, which was opened up at the beginning of plant operations but was abandoned due to the high percentage of sand at this point in the deposit. Surplus sand was dumped here until the old pit was filled and the flume extended to a point where it met the fill and choked up. A receiving box 6 ft. square and 10 ft. deep was then constructed at a point in the flume where the suction for a sand pump could be taken from the bottom. An 8-in. direct-connected sand pump driven by a 100-hp., 750-r.p.m. motor was then in-

stalled. The discharge pipe line was run out horizontally from the pump for 10 ft., then a 45 deg. elbow with 3-ft. radius was installed and the line raised on this angle until it was 30 ft. above the ground. It was carried at this height for 100 ft. on timber bents, but as soon as the waste fill built up sufficiently and extensions were required, only short bents, 3 or 4 ft. in height, were necessary to carry the line forward. The line was carried slightly down grade. This system worked successfully for about 800 ft., at which point another sand pump of the same design and size had to be installed as a booster. The discharge line at present extends approximately 250 ft. beyond the booster pump. The sand pumps are equipped with white-iron liners which last about three months. The runners last about the same length of time.

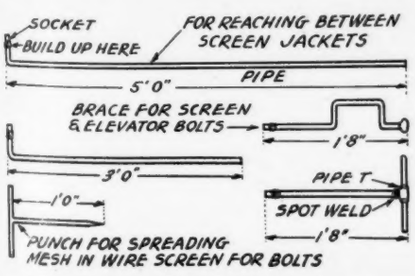
Occasionally, due to trouble at the power plant, the voltage drops or the power is shut off altogether, causing considerable delays because the water velocity in the pipe line is not sufficient to carry the sand, which settles and plugs the line. When this happens it is necessary to clean the line out before starting. To facilitate this work a 3-in. pipe nipple is welded on the top of each 20-ft. section of pipe and a 6-in. coupling and plug are welded to the bottom. With this arrangement a fire hose is connected to the 3-in. nipple and the 6-in. plug removed so that the sand is effectively washed out. However, at times it has been necessary to take the entire line apart and clean it out. The pipe sections are put together with flanges instead of screw joints. To prevent closing down the plant while the pipe line is being cleaned, a Y and valve are placed in the line near the pump and a short pipe line extended for emergency use. The cost of cleaning this pipe line is carried as a washing cost.

The pipe used is heavy casing and is turned one-quarter of the way around every three months to distribute wear, and in this way it lasts for approximately one year.

Handy Set of Wrenches

By Dare Paris
Monrovia, Calif.

REPAIRING jackets on revolving screens is oftentimes difficult. Tightening up loose bolts and putting on patches are a problem. Sometimes one finds it necessary to remove the outer jacket in order to repair the inner jacket. These are things that cut down output and increase costs.



Special socket wrenches are handy

The accompanying illustration shows a set of socket wrenches made up for this work which are very helpful in working on the screen jackets. They are made of pipe and can be made in the blacksmith shop with ordinary tools. The socket is formed by squaring the end of the pipe. The outside should then be built up with the welding torch as indicated in the illustration. This will keep the corners from splitting out. These wrenches will give good service for bolts not over ½ in. in size.

Discharging gravel in a series of cascades

Preventing Wear on Drag Scraper

By Dare Paris
Monrovia, Calif.

THIS ILLUSTRATION shows a method used to protect the drag scraper from wear which occurs chiefly on the sides and around the bottom. This is accomplished by taking old automobile axles and pieces of broken drill steel and welding them on to

Extra armor for scraper

the sides and bottom. They are also applied elsewhere on the scraper to protect against wear on rivet heads, as can be seen clearly in the illustration.

This drag scraper was equipped thus while practically new. It has been in use for four years in hard digging and the body itself shows very little wear.

Stone Ladder

A STONE LADDER is a device which allows stone or other aggregates to drop in a series of cascades rather than in one continuous fall. The latter, if the vertical distance of the drop is great, is apt to cause breakage. If such aggregate has already been screened and washed this secondary breakage is a contaminating evil and is to be avoided when possible.

At the Hoover dam aggregate up to 9-in. in diameter will be used and when such large aggregate is allowed to fall to the live storage pile there is apt to be excess fragmentation. The illustration shows how this is avoided.

The large sized gravel is transported to the pile on a belt conveyor that operates in the horizontal gallery and the material falls to the pile below over a series of short cascades. The latter are built of steel plate.

Blocks for Rerailing Cars

PRACTICALLY every quarry has more or less trouble with derailment of cars. The problem of rerailing is handled in various ways depending upon the particular derailment, whether or not the locomotive is involved, and upon the equipment at hand for rerailing.

One quarry reports, where it used blocks and pry poles, that in a short time the corners (running with the grain of the wood) of the blocks break or wear off until the blocks have rounded corners. This results in an accident hazard, for the blocks are likely to roll with the weight of cars upon them.

Of course with frequent replacing of blocks, this matter will give no bother. But with very little trouble and expense the ordinary quarry shop can shape some sheet iron around the corners, just sufficient to keep the corners from being broken off. By doing this blocks will last indefinitely. It is also advisable to use hard wood.

Since the blocks are out in the weather at all times, extra life can be gained by creosoting the blocks. Too much creosote should not be used as the blocks will tend to slip.

Rock Products News Briefs

Crushed Stone

Elmhurst-Chicago Stone Co., Elmhurst, Ill., celebrated a half century of service May 13. Nearly 400 people from all parts of Du Page county and from Chicago attended open-house festivities. A feature of the affair was a display of pictures shown by the company, some of them dating back to 1883, which graphically showed the history of the company during the past 50 years. Many floral pieces and messages of congratulation were received.

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Statistics of the industry for 1932 were released by the U. S. Bureau of Mines, June 1. They show a total production of 87,314,000 tons as against 132,562,680 in 1931. The following table gives a summary:

TABLE 1.—CRUSHED AND BROKEN STONE SOLD OR USED BY PRODUCERS IN THE UNITED STATES BY PRINCIPAL USES
(Tons of 2,000 lb.)

	1931	1932[1]	Gain or Loss, %
Concrete and road metal	65,811,522	42,800,000	— 35.0
Railway ballast	6,812,890	4,000,000	— 41.2
Cement manufacture	31,736,000	18,750,000	— 40.8
Flux stone	9,727,230	4,000,000	— 58.9
Lime manufacture	5,420,000	4,000,000	— 26.2
Alkali works	3,340,290	3,000,000	— 10.2
Rip rap	4,222,570	4,000,000	— 5.2
Agricultural limestone	1,421,050	950,000	— 33.1
Refractory stone	611,070	300,000	— 50.9
Slate granules and flour	229,980	204,000	— 11.3
Asphalt filler	247,450	160,000	— 35.1
Calcium carbide	164,180	150,000	— 8.5
Other uses	2,818,450	5,000,000	+ 120.
Total	132,562,680	87,314,000	— 34.1
Rock asphalt	470,491	314,027	— 33.3

[1]Subject to revision.

The average number of days worked in 1932 was 206; the average number of weeks worked 35.7, and the average hours worked per man per week was 48.6; the average length of shift 8.4 hr.

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Limestone screenings and molasses is a mixture being used for surfacing tennis courts at Grand Junction, Colo.

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Kingston Trap Rock Co., Plainfield, N. J., L. R. Gilbert, manager, has placed a contract with the Robins Conveying Belt Co., New York City, for a complete crushing plant, which will include five belt conveyors, 24-in., 30-in. and 36-in. wide, and three "Gyrex" screens 5x12 ft., one single-deck and two triple-deck. The crushing capacity of the plant will be 475 tons per hour, and the storing, screening and loading capacity 275 tons per hour.

National Safety Competition for 1932 included 322 mines and quarries in 34 states. The bronze trophy, "Sentinels of Safety," donated by the *Explosives Engineer*, was won in the quarry industry by the Michigan Limestone and Chemical Co., Rogers City, Mich., which operated 487,046 man-hours without a lost-time accident. Nearly 60 companies in the rock products industry received honorable mention in either the "nonmetallic mines" or the quarry groups.

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Sand and Gravel

Foley Brothers, Inc., St. Paul, Minn., are erecting a gravel plant at Jones Crossing, 6 miles west of Lexington, Miss. R. L. Kenning is superintendent.

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Federal Gravel Co. and **Michigan Gravel Co.,** Alpena, Mich., on June 6 got final action after more than five years' litigation against the Detroit and Mackinac Railway and the Alpena Gravel Co. in the state supreme court. The high court reduced to $60,000 a damage award to the two plaintiff gravel companies. The original award of $155,000 was made May 29, 1931, by Circuit Judge Houghton, Bay county, after three years of argument, testimony and more argument. The suit was started February 27, 1928, in the Bay county court; on March 10 of the same year a motion to dismiss was filed and was denied August 11; the state supreme court affirmed the denial and on March 3, 1930, the trial was started. Taking of testimony lasted several weeks. Final arguments of counsel were heard during the winter of 1930-31 and after several months of study, Judge Houghton gave the judgment. The Federal Gravel Co. owned two gravel pits, which it complained it had been forced to sell for $45,000 after the railroad had shown great preference to the Alpena Gravel Co., making competition impossible. The lower court set the value of the two pits at $200,000 in making the $155,000 award. The supreme court held the value of the pits at $105,000, making the award $60,000.

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Marshall Sand Co., Black Mountain, N. C., has been reorganized with R. L. Ellis, president; H. D. Childs, vice-president; Chas. G. Lee, Sr., treasurer, and M. G Buquo, secretary. The plant is at Ellerton N. C.

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Pacific Building Materials Co., Portland, Ore., has built a new sand and gravel plant on the east bank of the Willamette river, 7 miles south of Oregon City. The entire output at present is being taken by the West Contract Co. for highway work.

The plant occupies level ground, 50 ft. above the river, and sets back 100 ft. from the shore. The main part of the building provides bunker storage for 600 cu. yd. of ¼-in. paving sand, 130 cu. yd. of 1½-in. gravel and the same amount of 3-in. gravel. These bunker compartments rise from the ground level and the aggregates they hold are drawn down through gates to a belt conveyor that operates in a tunnel under the center of the building. Material fed to the conveyor in separate grades is discharged into the boot of a bucket elevator and carried to bins situated above a Blaw-Knox 1¼-cu. yd. batching hopper. These bins also serve as loading bins for truck delivery of non-batched sand and gravel.

In the top part of the building, above the bunkers, are the 3-section revolving screen and two-wheel classifiers for grading and dewatering the sand.

Material for the plant is taken from deposits on the river bed by a dredge equipped with a steam derrick, having a 70-ft. boom, for operating a Williams 3-cu. yd. clamshell bucket. The sand and gravel are loaded on a 250-cu. yd. barge, attached to the dredge, and by means of two deck engines and a system of cables the dredge and barge together are regularly moved between the digging ground near the west bank and the plant landing at the east bank, covering a distance of over 3000 ft.

About four hours are required to load the barge with 250 cu. yd. of unclassified sand and gravel, and close to five hours are required to move to the landing and transfer it to the receiving hopper, using the dredge clamshell bucket for both operations. A grizzly over the receiving hopper serves to reject all boulders of a diameter greater than 5 to 6 in. The undersize material passes from the hopper through a shuttle pan feeder to a 20-in. belt conveyor. The conveyor, 60 ft. in length, is driven at a speed of 300 ft. per min. by a 15-hp. motor. It makes a rise of 18 ft., delivering the material to a Chain Belt Co. bucket elevator at a rate of 50 cu. yd. per hour.

The elevator, extending to a height of 67 ft. on the outside of the building, has 12x6-in. buckets of 18-in. spacing, and is operated at a speed of 210 ft. per min. by a 25-hp. motor. It carries the material to a hopper that feeds to the set of 3-section washing and classifying screens.

The first section of the screen has a length of 7 ft., a diam. of 60 in., with ¼ by ½-in. rectangular screen openings for sand production. The second section, 8 ft. long and 48-in. diam., has 5 ft. of 1-in. and 3 ft. of 1½-in. round openings. The third, which is 4 ft. long and 48-in. diam., has 3-in. holes. The products are: Sand of ¼-in. minus; coarse aggregate running from ¼-in. to 1½ in. minus; and 1½-in. to 3-in. gravel.

The 3-section screen is operated at a speed of 12 r.p.m. by means of a chain-belt drive from a pulley on the bucket elevator.

All material passing the first section, or sand screen, is washed down to two wheel classifiers, operated partly submerged in a box-shaped flume, 18 ft. long, 24 in. deep and 28 in. wide. The water, running into the flume with the sand and slime, continuously overflows and, under moderate agitation, carries with it the lighter elements, including soil, silt and the sand finer than 28 mesh, all of which pass out through waste flumes. This leaves the heavier sand to be taken up by the sand-wheel dippers and discharged into the sand bunkers. In this process the sand saved by the wheels is thoroughly washed and dewatered. The saving effected by the two wheel classifiers varies, but it often amounts to 24 cu. yd. per hour. The sand below 28 mesh, cut out by the flume overflow method, amounts to about 2% of that which passes the ¼-in. screen. Each wheel classifier is driven at a speed of 3 to 5 r.p.m. by a 7½-hp. variable-speed motor. They may be operated singly or in unison.

The products of the second and third sections of the rotary screen are passed by gravity to the two gravel bins. The oversize material from the third screen section, running from 3-in. plus to 5-in., is spouted to a Wheeling jaw crusher, by which it is reduced to 2-in. minus, this product being passed to the main bucket elevator and returned thence to the revolving screen. The crusher is driven by a 30-hp. belt-connected motor.

The water required for the rotary screen and wheel classifiers, amounting to 250 g.p.m., is supplied by a Fairbanks-Morse 6-in. duplex, steam pump, through a 4-in. pipe. The 3-in. diam. spray bar, inside the screen, carries 54 ⅜-in. openings.

The wheel classifiers used in this plant were built on special design made in the office of this company; as was also the shuttle pan feeder that serves the main belt conveyor.

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Magnesite

Statistics of the industry for 1932 reflect the low state of the iron and steel industry. The total quantity of crude magnesite mined in the United States was 34,462 tons valued at $283,304, a decrease of 47.7% in quantity compared with 1931. Dead-burned magnesite was quoted in trade journals throughout 1932 at $25 per short ton f.o.b. California mines. The quotation for the high grade product known as "artificial periclase" (93 or 94% MgO) was $68 per ton through June 23; from June 30 through September 15 it was $65; September 22 it arose again to $68, and from September 29 till the end of the year it was quoted at $65 per ton. The 88% product continued unchanged, being quoted at $35 throughout the year. Dead-burned magnesite, which was quoted in trade journals at $22 f.o.b. Chewelah, Wash., throughout the year 1931, remained at that price until May 26 when it was quoted at $21 per short ton; June 23 the Washington dead-burned magnesite was again quoted at $22 per ton, but returned to $21 according to the June 30 quotation, rising again August 25 to $22, which was maintained till the end of the year. The price of high grade ground caustic calcined magnesite (95%) f.o.b. California producing points, which had been scaled down from $48 to $45 per short ton in August, 1931, was reduced to $38 June 30, 1932, and then rose to $45 September 22, but changed again to $38 September 29, which price was maintained till the end of the year; a corresponding revision was made in the quotation for 90% caustic from $40 to $35 on the same basis.

Pacific Building Materials Co. plant on Willamette River

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Silica

A Middle West Correspondent of Rock Products writes: "We are interested in immediately obtaining a dependable source of supply for a graded silica, fractured or quartz rock, running in fairly accurate grading minus 10-mesh, plus 18-mesh. This material must be light to clear white in color, so that it will reasonably receive our coloring treatment without throwing the color off between different particles, because of wide variance in the base color of the raw aggregate. We must also have a reasonable degree of hardness, and a free lime content under 3%. The material, naturally, must be washed, and free from clay and reasonably free of dust. We have recently closed a contract running for the next ten years, with specified minimum annual consumption of 200 carloads. We anticipate an actual minimum of 500 cars per year, from expressed intentions and demand already established. We thought that you might be in a position to advise us of companies with whom we could communicate with the idea in mind of getting practically an immediate source of supply of the above described materials. Certain limestone and quartzite quarries should be able to furnish us this material, and we trust that you may be able to put us in touch with such concerns." The editor will be glad to hear from interested producers.

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General

Asphalt production statistics in 1932 reflect its increasing use for secondary road, or the increasing percentage of secondary roads in the highway program. Sales of paving asphalt by petroleum refineries declined 23.8% (from 1,124,253 short tons in 1931 to 856,638 tons in 1932). The average value of paving asphalts sold in the United States decreased from $8.65 in 1931 to $7.41 in 1932. Sales of paving flux declined less, from 113,801 tons in 1931 to 107,468 tons in 1932. Sales of cut-back asphalts decreased slightly in quantity, from 446,413 short tons in 1931 to 440,838 tons in 1932. In relative importance, however, they gained, from 15.5% of all asphalt sold in 1931 to 18.3% of that sold in 1932. Refinery sales of asphalts and fluxes emulsified with water increased from 16,805 short tons (3,954,134 gal.) in 1931 to 44,354 tons (10,436,288 gal.) in 1932. In addition, 32,550,000 gal. of asphalt emulsions in 1931 and 25,800,000 gal. in 1932 were sold by industrial companies which emulsified asphalts or fluxes bought from petroleum refiners.

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Steel and plate glass industries are now reported working to approximately 50% capacity. Both are large users of rock products.

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Motor vehicle owners have paid federal taxes of $1,258,422,653 since 1918 and have had returned in the form of federal aid for highways only $1,190,160,055, according to figures compiled by the National Highway Users Conference.

You Need Your Association Now As Never Before

An Editorial

THE National Industrial Recovery Act is no sudden inspiration of the President's "brain trust." It had been in the making long before the stock market crash of 1929. It is the realization of the trend of thought of forward-looking business, industrial and political leaders for at least a dozen or a score of years—ever since the public through widely distributed stock ownership became the actual though not the active proprietor of big business and industry.

To that leadership the National Associations of business and industry have made important contributions. They and the business journals have furnished the forums to discuss and argue the various viewpoints, which have constantly broadened the outlook of business and industrial executives. The cynic who claims that human nature never changes is wrong; human nature changes little at a time, but it changes fundamentally by slow evolution.

A relatively few centuries ago our forebears observed no laws but the one of necessity. What they needed to support life they appropriated, provided they were physically capable of doing so. Those few centuries of community life and the development of a sense of mutual dependency have wrought great changes in human nature. Sad to admit, until very recent years business and industry were still conducted largely according to "jungle law."

The National Industrial Recovery Act is the first national government attempt since the passage of the anti-trust laws to inject some of the ethics of civilized society into business and industry. It comes at a time and under conditions that justify the law as a measure to meet a great national emergency. Yet it was bound to come anyway, as a matter of evolution.

The exact provisions of the act for the control of business and industry we will not expand upon here. Our file of comments from the daily press and from the business press, to date, contains enough material for a volume the size of Webster's dictionary. It is obvious that critics can pick any number of flaws in the law; it is equally obvious that few commentators realize that this law is not the sudden inspiration of a group of college professors, but the result of an industrial evolution that has been going on under their very noses for many years. It is *revolutionary* only to those who suddenly appreciate its significance.

Use Your Association

The National Associations in the rock products industry are actively promoting the interests of *their industries*. The associations in the mineral aggregate industries have been forced to drop much of their other activities to concentrate on the work made necessary under the new law. There is nothing in the law to compel the producers or manufacturers in an industry to join their national associations. In some of the codes suggested there is an attempt to write into them that all producers shall be made to share the cost of the administration of the codes. It is doubtful that this can be done, for it would be a delegation of taxing authority. Anyhow, we hope no producer will make it necessary to raise that issue.

Every member of an industry will be bound by the code drafted by his national association and approved by the President of the United States. It will not be optional with the producer, as has been the case under codes adopted with the Federal Trade Commission. The new codes will have all the force of law and will be enforced by the United States Department of Justice in United States Courts.

It is not the purpose of the law to eliminate competition or to hamper or restrict a producer in the exercise of his independent business judgment in so far as it does not injure his industry, or all industry. It is true, of course, that liberty of action will be circumscribed in numerous ways; but no more so than our freedom of action as individual members of society has been restricted in the interests of society as a whole.

The purpose of the law is to provide legal protection to the producer or manufacturer who wishes to adopt a liberal or generous view (in his own estimation, perhaps) of his obligations to labor and to the public. He is not going to be prevented from paying decent wages or put in jeopardy of bankruptcy by competitors who have no sense of such obligations to society. In President Roosevelt's opinion this type of industrialist and business executive out-numbers the more selfish and grasping kind. We hope he is right.

So it is up to the National Associations to cultivate this type of leadership. It is up to the members of an industry to provide the leadership. It is the plain duty of every last producer in an industry to join his association and share both responsibility and cost. The size of one's business, too big or too little, is no excuse for failure to cooperate, for so far as his business or his industry is concerned, he is facing a very real national emergency.

It should be quite apparent to all sober-minded people, who study the new law and the splendid, lucid, enthusiastic explanation of it by the President, who are also familiar with the evolutionary change that has been taking place in industry, that the President has placed squarely and inescapably a heavy responsibility on organized industry and business—on the so-called *trade associations*. They must find a way to govern industry in a manner acceptable to

society, or the national government as the agent of society, will be compelled to step in and run business and industry. That is the essence of the whole matter.

If the trade associations and their membership, which should include 100 per cent of their industries, meet courageously the issue in the spirit the President has presented it to them, we doubtless will have many years ahead of freedom of opportunity for individual initiative and for profit. Anything else is obnoxious to the great bulk of American public opinion today, and it is to be hoped always will be.

How the Law Will Work?

One man's guess as to just how the law will operate is as good as another's. The President and his Administrator, Hugh Johnson, are frank enough to say that they do not know, that the law is an experiment and doubtless faulty in many respects. But it can be amended or interpreted to meet any condition that arises. The enforcement, amendment and interpretation must depend on "the good faith and high purpose of American business."

It is primarily social legislation designed to provide work and a decent standard of living to the multitude of wage earners. There is no guarantee of profits to industry and there probably will be no direct price fixing. There will be a free interchange of cost and price information to permit producers and manufacturers to arrive at selling prices intelligently without danger of running afoul of the anti-trust laws. Probably this will be done through central selling agencies and so-called "open-price associations."

The coal industry is already operating in this manner, with the approval of the United States Supreme Court. The Appalachian Coals, Inc., sells the coal of a large number of competing producers, but the prices f. o. b. mines are not uniform. Quantity and quality are taken into consideration. But the prices are open to both producers and the public.

Other factors that affect competitive selling which can be regulated are: (1) Division of consuming territory into market areas, providing for plants best equipped to serve particular markets, to concentrate sales efforts in such districts; (2) adoption of uniform grading of products; (3) simplification and standardization of products; (4) cooperative advertising for the industry; (5) collection and interchange of credit information; (6) cooperative administration of insolvent debtors.

The biggest immediate problem, as we see it, will be a fair division of available business in such industries as rock products, which have large over-capacities. Elsewhere in this issue are two propositions for solving this problem, one by an engineer with no selfish interest in the industries, the other by a producer. The former seeks to keep open the path to progress, development, efficiency and initiative; the other seeks chiefly to maintain a price. These are published merely as suggestive of the trend in thinking, when we attempt to apply the generalities of the law to a particular industry.

Not the President, the law, nor the courts can solve problems like this, but the producers themselves can; and largely by application of the "golden rule," altruistic as that may appear. The golden rule, as we recall, is of Chinese origin and reads like this: "Do unto others as you would have them do unto you." That does not imply unselfishness in business; for in spite of all the laws and the prophets to the contrary business and industry are not yet looked upon as wholly *public services.* Men still engage in them for personal profit and prestige. Self-effacement is not called for, only observance of the rules of fair play.

Safety first, for the preservation of our ideals of individuality and freedom of opportunity, clearly indicates the wise course open to American business executives. As the *Wall Street Journal* recently said editorially: "Regardless of the personal opinions they happen individually to hold concerning the merits of this complicated mass of new enactments, their cue is to offer the Administration their whole-hearted and active assistance in making the new controls 'work' as well as lies within human capacity and external circumstance to do. Only in that way can they expect to see the trained judgment that ripens out of long experience making the contribution to the new business order without which it might come near to disaster. They can, if they will, do a great deal to ease the necessarily difficult task that confronts all business, that of reconciling the popular will expressed through political channels with the exigencies of trade. And they must realize that if political and private purposes should fall into outright conflict in the execution of the new control measures, the former will not readily give ground."

How the Coal Industry Is Functioning

APPALACHIAN COALS, Incorporated, does not have a monoply even in its various fields...it cannot control the activities of its competitors, either within the respective Appalachian fields, or in competing fields, according to James D. Francis, president, who explained its operation at the recent convention of the coal industry at Chicago as follows:

It can, and will, stabilize its own price structures...it will hope to set a good example and encourage its competitors to compete along legitimate, constructive lines.

The price structures on Appalachian coals will be established, just as far as humanly possible, with a proper relationship toward outside coals within its fields, and scientifically established relationship toward the products of others.

Appalachian Coals will not destroy established and familiar contacts with the public. The public may continue to buy from men in whom it has confidence. The only change that has been made has been to appoint these men as agents of Appalachian Coals and as sub-agents of the producers who report to Appalachian Coals instead of to the producer. Trade names will be observed as though this new organization had not been created.

When prices on spot sales are in question, the decision will not be based upon rumor and false report, but upon documentary evidence in the possession of the corporation. When sales are based on exact information rather than on surmise and deception, the major cause of market demoralization is removed.

The sales agency will direct the shipments of all coal from all mines controlled by its stockholders. No coal will leave any mine unless it has been sold to a bona fide buyer. There will be no consignments.

Recent Quotations on Rock Products Securities

Stock	Date	Bid	Asked	*Dividend
Allentown P. C. com.[47]	6-21-33	4	6	
Allentown P. C. pfd.[47]	6-21-33	6	8	
Alpha P. C. com.	6-22-33	19¼	20	
Alpha P. C. pfd.	6-17-32	70	....	1.75 qu. Mar. 15, '33
Amalgamated Phos. 6's, 1936[47]	6-21-33	92	94	
American Aggregates, com.[47]	6-21-33	1	2	
American Aggregates, pfd.[47]	6-21-33	10	12	
American Aggregates 6's, w. w.[47]	6-21-33	26	30	
American Aggregates 6's, ex. w.[47]	6-21-33	25	28	
American L. and S. 1st 7's[47]	6-21-33	34	36	
Arundel Corp. com.[47]	6-22-33	24 actual sale.		50c qu. Apr. 1, '33
Bessemer L. and C. Class A[47]	6-21-33	2	3	
Bessemer L. and C. 1st 6½'s[47]	6-21-33	17	20	
Bessemer L. and C. cert. of dep.[47]	6-21-33	17	20	
Bloomington Limestone 6's[47]	6-21-33	4	6	
Boston S. & G. new com.[37]	3-14-33	1	3	
Boston S. & G. new 7% pfd.[37]	3-14-33	10	20	1.75 qu. Jan. 3, '33
Boston S. & G. 7's, 1934[19]	3-14-33	50	60	
California Art Tile, A	3-18-33	½	1	
California Art Tile, B	3-18-26	....	¾	
Calaveras Cement, com.	6-15-33	1	4½	
Calaveras Cement, 7% pfd.	6-15-33	....	70	1.75 qu. Apr. 15, '33
Canada Cement, com.	6-18-33	6¼	6¾	
Canada Cement, pfd.	6-18-33	31¼	31½	
Canada Cement 5½'s, 1947	6-18-33	75	78	
Canada Crushed Stone bonds[42]	3-15-33	71½	....	
Canada Crushed Stone, com.[42]	3-15-33	No market		
Certainteed Products, com.	6-17-33	5⅝	5¾	
Certainteed Products, pfd.	6-17-23	21	30	
Certainteed Products, 5½'s, 1948	6-16-33	52 actual sale		
Cleveland Quarries	6-19-33	....	25	
Consolidated Cement 1st 6½'s A[47]	6-21-33	2	4	
Consolidated Cement, pfd.[47]	6 21-33	No market		
Consolidated Oka Sand and Gravel (Can.) 6½'s[32]	3-15-33	....	35	
Consolidated Oka Sand and Gravel (Can.) pfd.[42]	12-27-32	....	50	
Consolidated Rock Prod., com.[47]	6-21-33	25c	50c	
Consolidated Rock Prod., pfd.[47]	6-21-33	50c	75c	
Consolidated Rock Prod., units[47]	6-21-33	1	2	
Consolidated S. & G. pfd. (Can.)	1-16-32	....	50	
Construction Material, com.[47]	6-21-33	25c	50c	
Construction Material, pfd.[47]	6-21-33	1	2	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948[47]	6-21-33	17	20	
Coosa P. C., 1st 6's[47]	6 21-33	15	20	
Coplay Cement Mfg., pfd.[47]	6-21-33	5	8	
Coplay Cement Mfg. 6's, 1941[47]	6-21-33	45	50	
Dewey P. C. com.[47]	6-21-33	45	60	
Dolese and Shepard	6-22-33	6½	8½	
Dufferin Pav. & Cr. Stone, com.	6-18-33	2	6	
Dufferin Pav. & Cr. Stone, pfd.	6-18-33	15 actual sale		
Edison P. C. com.[47]	6-21-33	1	3	
Edison P. C. pfd.[47]	6-21-33	3	5	
Federal P. C. 6½'s, 1941[47]	6-21-33	52	57	
Giant Portland Cement, com.[47]	6-21 33	2	4	
Giant Portland Cement, pfd.[47]	6-21-33	5	7	
Gyp. Lime & Alabastine, Ltd.	6-17-26	4 actual sale		
Gyp. Lime & Alabastine 5½'s, 1948	6-16-33	42	44	
Hermitage Cement, com.[47]	6-21-32	10	15	
Hermitage Cement, pfd.[47]	6-21-33	30	40	
Ideal Cement 5's, 1943[47]	6-21-33	85	87	
Ideal Cement, com.[47]	6-21-33	28	30	25c qu. Apr. 1, '33
Indiana Limestone 6's[47]	6-21-33	15	20	
International Cem., com.	6-22-33	31	32	
International Cem. bonds, 5's.	6-16-33	80 actual sale		Semi-ann. int.
Kelley Island L. & T.	6-22-33	11	13	25c qu. Jan. 2, '33
Kentucky Cons. Stone, com.	6-18-33	....	¼	
Kentucky Cons. Stone, pfd.	6-18-33	....	10	
Kentucky Cons. Stone, 7% pfd.[47]	6-21-33	No market		
Kentucky Cons. Stone, 1st Mtg., 6½'s[47]	6-21-33	15	10	
Kentucky Cons. Stone, V. T. C.[47]	6-21-33	5	10	
Kentucky Rock Asphalt, com.	6-19-33	1	1½	
Kentucky Rock Asphalt, pfd.	6-19-33	9½	11	
Kentucky Rock Asphalt 6½'s, 1[illegible]	6-19-33	53	55	
Lawrence P. C.	6-17-33	7	10	
Lawrence P. C., 5½s, 1942[47]	6 21-33	37	40	
Lehigh P. C., com.	6-22-33	22	22¼	
Lehigh P. C., pfd.	6-17-33	68⅛	70	87½c qu. July 1, '33
Louisville Cement[47]	6-21-33	50	60	
Lyman-Richey, 1st 6's, 1937[47]	6-21-33	80	85	
Marbelite Corp., com. (cement pfs.)	3-13-33	5c	50c	
Marbelite Corp., pfd.	3-13-33	25c	....	
Marquette Cement, com.[47]	6-21-33	5	6½	
Marquette Cement, pfd.[47]	6-21-33	42	45	1.50 qu. Jan. 3, '33
Marquette Cement Mfg., 1st 5's, 1926[47]	6-21-33	60	65	
Marquette Cement Mfg., 1st 6's, 1936[46]	6-21-33	60	(nominal)	
Material Service Corp.[47]	6-21-33	5	7	
McGrady-Rodgers, 7% pfd.[47]	6-21-33	35	40	
McGrady-Rodgers, com.[47]	6-21-33	7	10	
Medusa P. C. com.[47]	6-21-33	8	10	
Medusa P. C. pfd.[47]	6-21-33	35	40	
Michigan L. and C., com.[47]	6-21-33	55	60	
Missouri Portland Cement	6-22-33	13¼	13½	
Monarch Cement, com.[47]	6-21-33	40	50	
Monolith Portland Midwest[47]	6-21-33	½	1	
Monolith P. C., com.[47]	6-21-33	1	2	
Monolith P. C. pfd.[47]	6-21-33	2	3	
Monolith P. C. units[47]	6-21-33	3	5	
Monolith P. C. 1st Mtg. 6's[47]	6-21-33	55	60	
National Cem. (Can.) 1st 7's	2-21-33	70	80	(nominal)
National Gypsum A com.	6-22-33	6	7	
National Gypsum pfd.	6-22-33	52	....	1.75 qu. Apr. 1, '33
National Gypsum, 6's[47]	6-21-33	70	75	
National L. & S. 6½'s, 1941[47]	6-21-33	60	65	
Nazareth Cement, com.[47]	6-21-33	2	3	
Nazareth Cement, pfd.[47]	6-21-33	10	15	
Newaygo Portland Cement, 1st 6½'s[47]	6-21-33	30	35	
New England Lime 6's, 1935[14]	2-16-33	10	(nominal)	
New York Trap Rock 1st 6's, 1946	6-16-33	55	64	
New York Trap Rock, 7% pfd.[47]	6-21-33	30	35	1.75 qu. Jan. 3, '33
North American Cement, 1st 6½'s[47]	6-21-33	8	10	
North American Cement, com.[42]	6-21-33	1	2	
North American Cement, 7% pfd.[47]	6-21-33	3	5	
North Shore Material, 1st 6's[47]	6-21-33	30	40	
Northwestern States P. C.[47]	6-21-33	30	33	
Ohio River S & G. com.[47]	6-21-33	2	4	
Ohio River S and G, 1st pfd.[47]	6-21-33	30	35	
Ohio River S and G, 2nd pfd.[47]	6-21-33	10	15	
Ohio River S and G, 6's[47]	6-21-33	35	40	
Oregon P. C. com.[47]	6-21-33	7	10	
Oregon P. C. pfd.[47]	6-21-33	65	70	
Pacific Coast Aggr. com.[40]	3-13-33	....	1	
Pacific Coast Aggr. pfd.[40]	3-13-33	....	2	
Pacific Coast Aggr. 6½'s, 1944[5]	12-23-32	10	11	
Pacific Coast Aggr. 7's, 1939[5]	12-23-32	3	5	
Pacific Coast Cement 6's, 1937[47]	6-21-33	88	90	
Pacific P. C. com.	6-15-33	3 actual sale		
Pacific P. C. pfd.	6-15-32	21¾ actual sale		
Pacific P. C. 6½'s pfd.	5-15-33	20	25	1.62½ qu. Jan. 5, '33
Pacific P. C. 6's, 1935[47]	6-21-33	85	87	
Peerless Cement, com.[47]	6-21-33	50c	75c	
Peerless Cement, pfd.[47]	6-21-33	2	3	
Penn-Dixie Cement, com.	6-22-33	7⅛	7½	
Penn-Dixie Cement, pfd.	6-22-33	30	31	
Penn-Dixie Cement 6's	6-16-33	57	63	
Penn. Glass Sand Corp., pfd.[47]	6-21-33	40	45	
Penn. Glass Sand Corp. 6's[47]	6-21-32	75	80	
Petoskey P. C. com.	6-22-33	90c	1.50	
Petoskey P. C. 6's, 1941	5-23-33	30	33	
Port Stockton Cement, com.[9]	3-18-33	No market		
Republic P. C. 6's, 1943	6-13-33	49	52	
Riverside Cement, A[47]	6-21-33	4	5	
Riverside Cement, B[47]	6-21-33	1	1½	
Riverside Cement, pfd.[47]	6-21-33	50	55	1.50 qu. May 1, '33
Sandusky Cement 6's[47]	6-21-33	30	35	
Sandusky Cement 6½'s, 1932-37[47]	6-21-33	40	45	
Santa Cruz P. C. com.[47]	6-21-33	50	55	1.00 qu. Apr. 1, '33
Schumacher Wallboard, com.[47]	6-21-33	1	2	
Schumacher Wallboard, pfd.[47]	6-21-33	3	5	
Signal Mt. P. C. pfd.[47]	6-21-33	6	10	
Southwestern P. C., units[47]	6-21-33	120	130	
Southwestern P. C. com.[47]	6-21-33	10	15	1.00 qu. Jan. 1, '33
Southwestern P. C. pfd.[47]	6-21-33	70	75	2.00 qu. Jan. 1, '33
Standard Paving and Material (Can.) com.[47]	6 21-33	1	2	
Standard Paving and Material, pfd.[47]	6-21-33	40	50	
Superior P. C., A[47]	6-21-33	30	35	27½c mo. May 1, '33
Superior P. C., B[47]	6-21-33	6	7	
Trinity P. C., units[47]	6-21-33	16	20	
Trinity P. C. com.[47]	6-21-33	5	10	
Trinity P. C. pfd.[47]	6-21 33	12	18	
U. S. Gypsum, com.	6-22-33	40	42	25c qu. July 1, '33
U. S. Gypsum pfd.	6-22-33	110	113	1.75 qu. July 1, '33
Wabash P. C.[47]	6-21-33	4	5	
Warner Company, com.[47]	6-21-33	2	3	
Warner Company, 1st 7% pfd.[47]	6-21-33	15	20	
Warner Co. 6's, 1944, w. w.[47]	6-21-33	7	10	
Warner Company 6's, 1944, ex. w.	6-16-33	21	40	
Whitehall Cement Mfg. com.[47]	6-21-33	7	10	
Whitehall Cement Mfg. pfd.[47]	6-21-33	20	25	
Wisconsin L. and C., 1st 6's, 1933[47]	6-21-33	60	70	
Wisconsin L. and C., 6½'s[47]	6-21-33	66	70	
Wolverine P. C. com.[47]	6-21-33	1	2	
Yosemite P. C., A com.[47]	6-21-32	1½	3	

Quotations by: [5]Smith, Camp & Riley, San Francisco, Calif. [9]A. E. White Co., San Francisco, Calif. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [14]First Wisconsin Co., Milwaukee, Wis. [19] Hewitt, Ladin & Co., New York. [37]Wise, Hobbs & Arnold, Boston. [40]Martin Judge Co., San Francisco, Calif. [42]Nesbitt, Thompson &- Co., Toronto. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill.

Volunteer Portland Cement Co., Knoxville, Tenn., for the years ending December 31, reports:

	1932	1931
Sales	$477,806	$1,071,317
Cost, expense and depreciation	413,317	932,217
Operating profit	64,489	139,100
Other income	8,267	4,073
Total income	72,756	143,173
Interest charges	40,246	37,420
Other deductions	85,719	6,010
Net income	(d)53,210	99,743

Total assets were reduced to $1,902,223 from $1,925,526 in 1931. Current assets as of December 31, 1932, were $315,951 against current liabilities of $67,321. No common dividends have ever been paid. The last preferred dividend was August 1, 1931; the preferred dividends in arrears December 31, 1932, amounted to $306,250.

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Yosemite Portland Cement Co., San Francisco, Calif., for the years ending December 31, reports:

	1932	1931
Sales	$405,574	$706,247
Cost of sales	338,803	516,029
Administration and selling expenses	104,533	115,117
Operating profit	(d)37,762	75,100
Other income (net)	21,902	(dr.)26,977
Net income	(d)15,860	48,123
Surplus charges	9,050	2,976
Surplus for year	(d)24,910	45,147

Total assets were reduced to $4,427,456 from $4,444,236 in 1931. Current assets as of December 31, 1932, were $744,785 against current liabilities of $27,291. The working capital was $717,494 against $680,398 on December 31, 1931.

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Monolith Portland Cement Co., Los Angeles, Calif., reports for the years ended December 31:

	1932	1931
Net sales	$1,101,976	$1,452,047
Costs and expenses	987,210	1,154,108
Depreciation	212,368	208,172
Balance	(d)97,602	89,766
Interest, discount, etc.	43,909	71,980
Other deductions	20,580	22,585
Net loss	162,092	4,799
Earned per share, com.	(d)$1.25	(d)$0.55

Total assets were reduced to $13,054,659 from 13,569,651 in 1931. Current assets as of December 31, 1932, were $505,271 against current liabilities of $184,142. No dividends, common or preferred, have been paid since January 1, 1930.

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Lyman-Richey Sand and Gravel Co., Omaha, Neb., on June 6, 1933, Omaha National Bank, Omaha, trustee, advised that $29,000 principal installment due June 1, 1933, on company's first serial 6s had not been paid, and that company had requested deposit of all bonds in order to effect an extension of all maturities for five years.

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Schumacher Wall Board Corp., Los Angeles, Calif., gypsum products manufacturer, reports that for the fiscal year ended April 30, 1933, the company sustained a net loss after depreciation of $54,978, which includes $25,571 loss on investment in Gypsum Products Corp., Seattle, Wash. During the year, the directors took advantage of low security prices and purchased and retired 204 shares of preferred stock. The cash position and working capital ratio of the company remains approximately the same as at the end of last year.

The balance sheet of the company as of April 30, 1933, shows the following:

ASSETS

Current assets		$ 122,783.46
Investments in other companies		189,245.98
Plant and equipment	$619,035.49	
Less reserve for depreciation	248,498.44	370,537.05
Gypsum deposits		10,000.00
Trade-marks and good will		350,000.00
Deferred charges		26,672.75
		$1,069,239.24

LIABILITIES

Current liabilities		$ 61,511.11
Other liabilities		10,650.00
Capital stock		
29,747 shares preferred.	$878,888.82	
66,000 shares common..	66,000.00	944,888.82
Surplus		52,189.31
		$1,069,239.24

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Rockland and Rockport Lime Corp., Rockland, Me., reports for the years ended December 31:

Consolidated Income Account—

	1932	1931
Gross income	$402,761	$648,469
Operating expenses	448,570	676,561
Net operating loss	45,809	28,092
Other income	15,073	16,523
Gross loss	30,736	11,569
Interest, depletion and depreciation	164,268	175,422
Net loss	195,004	186,991

Income account (company only)

	1932	1931
Gross income	$183,544	$269,002
Operating expenses	239,962	356,460
Depreciation and interest	88,864	96,268
Operating loss	145,282	183,726
Other income	12,444	12,756
Net loss	132,838	170,970

Current assets as of December 31, 1932 were $96,507 against current liabilities of $335,322. The last common dividend was paid November 1, 1925; the last second preferred dividend August 1, 1927, the last first preferred February 1, 1928.

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Limestone Products Corp. of America, Newton, N. J., reports for the years ended December 31:

	1932	1931
Sales	$184,915	$298,466
Cost of sales	77,655	117,022
Expense, interest, etc.	89,985	137,337
Depreciation	38,176	36,908
Depletion	2,580	4,060
Operating profit	(d)23,482	3,138
Other income	1,400	2,454
Net income	(d)22,082	5,592
Earned per share, pfd.	(d)$2.82	$0.71

Current assets as of December 31, 1932, were $91,045 against current liabilities of $42,547. Working capital was increased to $48,498 from $33,576 in 1931. Shipments for 1932 were 77,417 tons against 121,799 in 1931.

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Peerless Portland Cement Corp., Detroit, Mich.; a petition for voluntary dissolution of the corporation has been filed in circuit court by officers and directors of the company. They claim the company had pledged all of its assets to secure a $1,750,000 bonded indebtedness.

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Pennsylvania-Dixie Cement Corp., New York City; the stockholders on May 2 approved a proposal to change the authorized capital stock from 200,000 shares of preferred stock, par $100, and 1,000,000 shares of common stock, without par value, to 125,000 shares of preferred stock, par $100, and 587,500 shares of common stock, par $1.

American Aggregates Corp., Greenville, Ohio, stockholders have approved the financial reorganization plan (Rock Products, May 25, p. 35). Up to May 10 holders of 65% of the debenture bonds had assented.

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Alpha Portland Cement Co., Easton Penn., reports for the year ended December 31, 1932, consolidated income account:

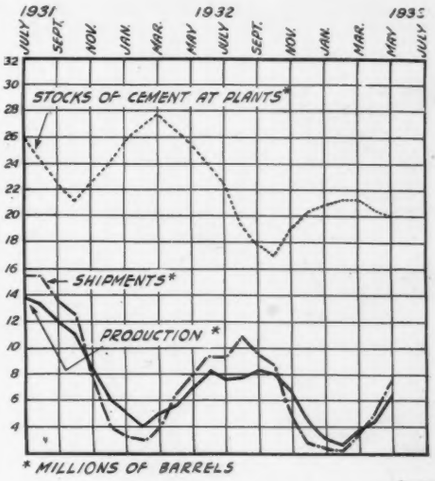
	1932	1931
Net sales	$3,857,756	$6,012,602
Expenses	4,313,218	5,645,344
Depreciation	1,406,264	1,370,199
Operating loss	1,861,726	1,002,941
Other income (net)	85,084	223,990
Loss	1,776,642	778,951
Minority interest	(cr)13,026	.....
Net loss	1,763,616	778,951
Preferred dividends	140,000	140,000
Common dividends	171,475	711,000
Deficit for year	2,075,091	1,629,951

Total assets were reduced from $29,010,508 on December 31, 1931, to $26,959,929 on December 31, 1932. Current assets were $7,707,696 against current liabilities of $173,363, as of December 31, 1932.

Cement Production—May

THE portland cement industry in May, 1933, produced 6,266,000 bbl., shipped 6,748,000 bbl. from the mills, and had in stock at the end of the month 20,060,000 bbl. Production of portland cement in May, 1933, showed a decrease of 9.4% and shipments a decrease of 15.9%, as compared with May, 1932. Portland cement stocks at mills were 21% lower than a year ago.

The statistics here given are compiled from reports for May, received by the Bureau of Mines, from all manufacturing plants except four, for which estimates have been included in lieu of actual returns.



Shipments in May

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 164 plants at the close of May, 1933, and of 165 plants at the close of May, 1932.

RATIO (PER CENT) OF PRODUCTION TO CAPACITY

	May		Apr.	Mar.	Feb.
	1932	1933	1933	1933	1933
The month	30.2	27.4	18.9	16.1	13.4
12 months ended	38.9	26.0	26.2	26.7	27.1

TRAFFIC and TRANSPORTATION

Proposed Rate Changes

THE FOLLOWING are the latest proposed changes in freight rates up to the week ending June 17:

New England

29872. **Stone,** broken or crushed (See Note 3), from Westfield (Hampden Quarry, Mass., to Andover, Conn. (Present $1.11 N. T.) Proposed, 70 N. T. (To Expire December 31, 1933.)

29219. To revise rates on **crushed stone** and **crushed marble** (terrazzo aggregate), C. L., in bulk or in bags, in box cars (See Note 3), from Brandon and Middlebury, Vt., to New England, Trunk Line and Central Freight Association territories via all available routes on proposed basis of 17½% of first class Docket 15879 rates.

29707. **Limestone,** broken, crushed or ground, minimum weight 50,000 lb., from Canaan, Danbury, East Canaan, Redding, Conn., and West Stockbridge, Mass., to stations on the B. & Ar., C. P. and C. V. Ry. Proposed, same basis as published from Ashley Falls, Lee, Mass., and Falls Village, Conn., to stations on the C. P., B. & Ar. and A. V. Rs. under N. Y., N. H. & H. R. R., I. C. C. Nos. F-3105 and 3257. (Present, sixth class.)

Trunk Line

30920. To cancel commodity rates on **lime and ground limestone,** carload, from Carpenterville, N. J., Philadelphia stations, Quarryville, Port Royal, Goodman, Moores Mill, Milroy, Pa., Wilmington stations, Del., Avondale, Pa., Middletown, Del., Spring Grove to Hanover, Littlestown, Pa., Union Bridge, Ladiesburg, New Midway, Walkersville, Md., Strickler, Emigsville, Lemoyne, Turbotville to Fowlersville, Pa., inclusive, Falling Waters and Bunker Hill, W. Va., to various destinations as shown in P. R. R. Tariff I. C. C. 204.

Sup. 1 to 30788. To amend rates on **sand and ground flint,** C. L., from Hancock, W. Va., etc., to Wellsboro, Pa., by adding Hancock and Round Top, Md., as points of origin on same basis of rates as proposed from Hancock, W. Va.

30938. **Crushed stone,** C. L., as desecribed on page 3, B. & O. R. R. I. C. C. No. 21605 (See Note 2), from Casparis, Pa., to Waynesburg, Pa., 80c per net ton, to expire Sept. 30, 1933.

30945. **Crushed stone, natural, carload and crushed stone, coated with oil, tar or asphaltum,** carload (see note).

Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity shipped, the shipper to so certify on shipping order and bill of lading.

Applying (See Note 2) from Bethlehem, Pa., to points on the W. B. & E., N. Y. S. & W., L. & W. V., D. & H., N. Y. O. & W., D. L. & W., L. V. R. R. and L. & N. E. R. R. On uncoated stone rates ranging from 80c to $1.70, and on coated stone rates ranging from 90c to $1.80 per net ton.

30946. **Stone, natural** (other than bituminous asphalt, rock), **crushed,** C. L., **stone, natural** (other than bituminous asphalt rock), **crushed, coated with oil, tar or asphaltum,** C. L. (see note).

Note—The weight of the oil, tar and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading.

Applying (See Note 2) from Rosendale, Marlboro, South Bethlehem, Feura Bush, Tomkins Cove, South Amsterdam, Little Falls, Green Island, Utica, Syracuse and Harvestraw, N. Y., to Rondout Station, Mt. Pleasant, Fleishman's, Stamford, Bloomville, Oneonta, Chichester, Tannersville, Kaaterskill, Hunter, N. Y., and various. On uncoated stone rates ranging from 90c to $1.90 and on coated stone rates ranging from $1.30 to $2.30 per net ton.

30964. To cancel rates on **limestone,** C. L., from Franklin, N. J., to stations on C. R. R. of N. J., D. L. & W. R. R., Ironton R. R., L. & W. V. R. R., L. V. R. R. and New York Central R. R., shown in D. L. & W., I. C. C. Nos. 20431, 20452, 22985, 21419, 22921, 20451, 20817 and 22986. Cancel rates on **lime,** carloads from Franklin, N. J., to D. L. & W. R. R. stations shown in D. L. & W. R. R., I. C. C. No. 22142.

30978 (shipper). **Foundry sand,** C. L. (See Note 2), from Wolverton to Nescopeck, Pa., to Blossburg, Pa., $2 per net ton. (Present rate $2.90 per net ton.)

M-3228. **Crushed stone,** C. L. (See Note 2), from Engle, Martinsburg, Millville, W. Va., Grove, Frederick and Security, Md., to destinations on the Pope's Creek branch of the P. R. R. and stations on the W. B. & Pt. L. R. R. Rates ranging from $1.30 to $1.70 per net ton.

30984. **Slag, coated with oil, tar or asphaltum,** C. L. (See Note 2), from Sparrows Point, Md., to New Market, Hughesville and Forest Hall, Md., $1.65 per net ton. (Present rate $1.80 per net ton.)

30989. (A) **Stone, natural, crushed or broken, uncoated,** C. L. (B), **stone, natural or broken, coated with tar, asphaltum or oil** (see note), C. L.

Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading.

Minimum weight 90% of marked capacity of car, from Oriskany Falls, N. Y., and Munns, N. Y., to D. & H. R. R. stations—Wilkesbarre, Providence, Carbondale, Seward, Schoharie Jct., and various. (A) Rates ranging from $1.40 to $1.85 and (B) rates ranging from $1.50 to $1.95 per net ton. Reason: Proposed rates are comparable with rates from Jamesville, N. Y.

30761. (Sup. 1.) **Granulated slag** (the product of iron and steel furnace), in bulk, in open top equipment, C. L. (See Note 2), 90% of marked capacity of car, from Pittsburgh, Bessemer, Kenny Yard and Clairton, Pa., to Blue Bell and Williams, Pa., $3.15 per net ton. No change to be made in the present rates to York, Swedeland and Conshohocken, Pa.

31004. **Granulated slag,** in bulk in bags, in closed cars, C. L., minimum weight 50,000 lb., from Clairton, Bessemer, Homestead, Rankin, Wylie (Clairton), Mifflin Jct., also all Union Railroad stations to Everett, Mass., 21c per 100 lb.

31012 (shipper). (A) **Building lime,** C. L., minimum weight 30,000 lb.; (B) **agricultural land, chemical, gas or glass lime,** C. L., minimum weight 30,000 lb., also **ground limestone,** C. L., minimum weight 50,000 lb., from Union Stone Co., Billmyer, Bainbridge, Rheems, York stations and Campbell to Wrightsville, Pa., to Secaucus to Fox Hill, N. J.; Roseville Ave. to Montclair, N. J.; East Orange to Summit, N. J., and Chatham to Wharton, N. J. (A) 14½c and (B) 14c per 100 lb.

31016. **Crude gypsum rock,** not ground (See Note 2), but not less than 80,000 lb., from Chester and Marcus Hook, Pa., to Devault, Pa., 85c per net ton. (Present rate, 11c per 100 lb., sixth class.)

31017. To amend Items 3570A to 3585D, inclusive, in Sup. 67, Curlett's I. C. C. A306, covering commodity rates on **crude, fluxing, foundry and furnace limestone,** from Thomasville, Pa., and other points of production on the W. M. Ry. to destinations in C. F. A. territory, which rates are now subject to routing provided in W. M. Ry. Westbound Routing Guide, I. C. C. 8215, by adding specific routes.

31018. **Stone, viz.: Crushed, screenings** (including crushed limestone and limestone screenings), in straight or mixed C. L., in open top cars (See Note 2), from Hillsville, Pa., and Shaw Jct., Pa., to Starford, Pa., $1.60 per net ton, plus emergency charge. (Present rate $3.30 per net ton, plus emergency charge).

31025. **Stone, natural** (other than bituminous asphalt rock), **crushed,** C. L. (See Note 2), from New Hamburg, N. Y., to 130th St. and 60th St., New York, N. Y., $1.20, and 33rd St., New York, N. Y., $1.30 per net ton.

Central

35947. To establish on **crushed stone,** coated with oil, tar or asphaltum, C. L. from Bridgeport, O., to points in Ohio, Pennsylvania and West Virginia, rates as shown in Exhibit A attached.

Stone, crushed, coated with oil, tar or asphaltum, carloads (known as "Amesite," "carbo-rock" or "emescrete"). Rates in cents per ton of 2,000 lb. From Bridgeport, O., to W. & L. E. Ry. representative points: Canton, O., 142; Bolivar, O., 130; New Cumberland, O., 119; Jewett, O., 107; Blairmont, O., 96; St. Clairsville, O., 107; Neffs, O., 119; Herrick, O., 96; East Canton, O., 142; Hibbetts, O., 130.

To P. & W. Va. Ry.: Hopedale, O., 107; Smithfield, O., 107; Kolmont, O., 96; Rockdale, W. Va., 96; Louise, W. Va., 96; Cliffton ville, W. Va., 107; Avella, Pa., 107.

To N. Y C. R. R. (Alliance Division) representative points: Alliance, O., 142; Center Road, O., 130; Augusta, O., 119; Wattsville, O., 119; Amsterdam, O., 107; Florence, O., 96; Smithfield, O., 96.

35999. To establish on **burnt** or **refuse foundry sand,** C. L., in open top cars from Berea, O., to Sandusky, O., rate of 90c per net ton. Present, $1.40 per net ton (intermediate application of foundry sand rate Conneaut, O., to Sandusky).

36023. To establish on **furnace or foundry limestone,** C. L., in open top cars, from Cleveland, O., to Mingo Junction, O., rate of *$1.05 per G. T., to expire 6 months after effective date, via P. R. R. direct, also W. & L. E. R. R. direct. Present, *17c.

*No emergency charge in addition, at present; however, in event emergency charges are later applied on Ohio intrastate traffic, such charges will be in addition to the proposed rate.

36051. To establish on **limestone,** agricultural, ground or pulverized, in bags or in bulk in box cars, in straight carloads, minimum weight 60,000 lb., from Piqua, O

[Rates in cents per net ton.]

Route	Route	Prop.	Pres.
Sturgis, Mich.	1	165	220
Kalamazoo, Mich.	1	175	240
Grand Rapids, Mich.	1	185	280
Quincy, Mich.	2	187	220
Lansing, Mich.	3	197	260
Jackson, Mich.	4	182	220

Routes—1, P. R. R., direct; 2, P. R. R., Sturgis and N. Y. C.; 3, P. R. R., Ft. Wayne and N. Y. C.; 4, P. R. R., Meekers and C. N.

36052. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding and silica), and gravel, C. L., from Urbana, O., to Gettysburg, 50c; Bradford, Piqua and Covington, O., 45c per net ton. Present, 70c to Gettysburg and 60c per net ton to Bradford, Piqua and Covington, O.

36129. To establish on **furnace or foundry limestone,** C. L., in open top cars (See Note 3), from Cleveland, O., to Steubenville, O., †$1.05, and to Wheeling, W. Va., *$1.13 per G. T., to expire six months after effective date, via P. R. R. direct; also via W. & L. E. R. R. direct. Present, †17c to Steubenville, O., and *18c. †No emergency charge in addition, at present; however, in event emergency charges are later applied on Ohio intrastate traffic, such charges will be in addition to the proposed rate. *Plus emergency charge.

36135. To establish on **slag,** granulated (light concrete aggregate), C. L. (See Note 3), from Chicago, Ill., and points in the Chicago district, including Gary, Ind., to Narco, Ky., rate of $2.30 per N. T., plus emergency charge of 6c per ton. (Present rate, $2.90 per N. T., made up of $2 to Ohio River and 90c beyond.)

36179. To establish on **stone,** viz., crushed, screenings (including crushed limestone and limestone screenings), in straight or mixed C. L., in open top cars, to Starford, Pa., from Hillsville and Shaw Jct., Pa., rate of $1.60 per N. T., plus emergency charge. Route: Via P. & L. E. R. R., Youngstown (N. Y. C. Jct.), O., and N. Y. C. R. R. (Present, $3.30 per N. T., plus emergency charge.)

Southwestern

1061. **Rock, asphalt and stone,** from Texas points to Fenway and Wayland, Mo. To establish a rate of $5.50 per ton of 2,000 lb. on asphalt rock, natural or coated with not to exceed 5% of road oil, crushed or ground; stone, coated with not to exceed 5% of road oil, crushed or ground, in straight or mixed carloads (See Note 1), but not less than 50,000 lb. from Blewett, Cline, Dabney, La Pryor, to Pulliam, Uvalde and Whitesmine, Tex., to Fenway and Wayland, Mo. Same rate as in effect to Des Moines, Martensdale, Mystic, Ottumwa and Richland, Ia., etc.

7966-4-TX. **Sand and gravel, straight or mixed carloads,** from Hobbs Spur, Tex., to Troy, Tex.: To establish rate of 27c per ton of 2,000 lb. (See Note 3) from Hobbs Spur,

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Tex., to Troy, Tex. To expire September 30, 1933. Proposed rate to meet truck competition.

1105. **Asphalt rock, clay, gravel, etc.,** between points in Arkansas, Louisiana, Missouri, Oklahoma, etc., and Thebes, Ill. To establish on asphalt rock, clay, gravel, sand, silica sand, stone and other articles as described in Items Nos. 5, 7 and 10, S. W. L. Tariff 152-F, I. C. C. 2496, C. L., between points in Arkansas, Louisiana, Missouri, Oklahoma and Texas, as covered by said tariff, on the one hand, and East St. Louis, Ill., on the other, the mileage scale applicable to and from St. Louis.

1204. **Asphalt rock, stone, sand, gravel, etc.,** from, to and between points in the Southwest. To amend S. W. L. Tariff 162-F applying on asphalt rock, clay, gravel, sand, etc., as described in Items 57 and 10-A, to provide that rates on shipments which move via routes exceeding the circuity provided in Item 270 shall be based on the distance via actual routes of movement.

1240. **Silica sand,** from Guion, Ark., to El Paso, Tex. To establish a rate of $4.55 per ton of 2,000 lb. on silica sand, C. L. (See Note 3), from Guion, Ark., to El Paso, Tex.

25480. Asphalt rock (bituminous) from Dougherty, Okla., to Trenton, Mo., via Kirksville and Blythedale, Mo., inapplicable; applicable rates, 38 and 30c, respectively. Rate from Dougherty to Manhattan, Kan., unreasonable to extent it exceeded 17c; applicable rates to Trenton direct, Trenton via Kirksville and Blythedale, unreasonable to extent they exceeded 19, 21 and 19.5c respectively. Reparation proposed. Outstanding undercharges should be waived.

Southern

1694. **Marble waste,** viz., broken slabs, marble spalls and marble mill waste, C. L., Knoxville, Tenn., to Nelson and Albemarle Ry. stations, viz., Bridgeport, Schuyler, Snow, Ruffin, Damon, Melvale, Bolling, Esmont, Coles and Alberene, Va. Present rate, combination. Proposed rate on marble waste, viz., broken slabs, marble spalls and marble mill waste, C. L. (See Note 3), from and to the above named points, $2.10 per net ton (subject to emergency charge).

1720. **Slag** (except ground basic slag), granulated, lump or pulverized, C. L., Nashville, Tenn., to Indianapolis, Ind., Columbus, Cleveland, and Toledo, O. (Present rate, combination.) Proposed rate on slag (except ground basic slag), granulated, lump, or pulverized, in packages or in bulk, C. L. (See Note 3), from Nashville, Tenn., to Indianapolis, Ind., $2.45; Columbus, O., $2.45; Cleveland, O., $3.05; Toledo, O., $2.95 per net ton.

1721. **Slag** (except ground basic slag), granulated, lump or pulverized, C. L., from Nashville, Tenn., to Chicago and Springfield, Ill., also from Chicago, Ill., to Nashville, Tenn. (Present, combination.) Proposed rates on slag (except ground basic slag, granulated, lump, or pulverized, in packages in bulk, C. L. (See Note 3), from Nashville, Tenn., to Chicago, Ill., $2.80; Springfield, Ill., $2.60; also from Chicago, Ill., to Nashville, Tenn., $2.80 per net ton.

1722. **Clay gravel,** C. L., Camden, Tenn., to Memphis, Tenn., when destined points west of the Mississippi River. (Present rate, $1.30 per net ton, interstate.) Proposed rate on clay gravel, C. L. (See Note 3), from and to the above named points, 79c per net ton (subject to Agent Speiden's Tariff of Emergency Charges, I. C. C. 1616).

1810. **Stone:** viz., limestone or marble, ground or pulverized, C. L., Cartersville, Ga., to Watervliet, Mich. (Present rate, $5.15 per net ton.) Proposed rate on stone, viz., limestone or marble, ground or pulverized to fineness to pass through a screen of 200 mesh to the inch, in bulk, or in bulk in bags or barrels, C. L., minimum weight, 60,000 lb., from Cartersville, Ga., to Watervliet, Mich., $4.89 per net ton (subject to emergency charges)—same as currently in effect to Kalamazoo, Mich.

Illinois

7352. **Limestone, ground,** L. C. L. in cartons, in barrels or boxes, or in bulk in bags, barrels or boxes, between all points in I. R. C. territory. Proposed, sixth class, minimum rate 10c.

Western

5063-I. List D. **Stone, viz., broken, crushed, rubble or rip rap, chatts (lead or zinc mine refuse.)** (See Note 3.) In no case shall the minimum weight be less than 40,000 lb.

7270-C. Rates: **Stone,** crushed; **chatts, rubble stone, rip rap, strippings,** quarry (See Note 3), but in no case less than 40,000 lb., from Dell Rapids, S. D., to Mexico, Mo. Rates, present—Combination basis. Propcsed —13½c per 100 lb.

Sup. 2 to 8414. Rates, **sand,** viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, moulding or silica, from Pacific and Gray's Summit, Mo., to Kansas City, Mo.-Kan. Rates, present, $1.70 per net ton; proposed, $1.40 per net ton.

Sup. 1. to 6146-P. Minimum weight, **sand,** C. L., as described in W. T. L. Tariff 41-S, I. C. C. A-2243, from Browntown, Wis., to Benton Harbor, Detroit, Flint and Muskegon, Mich. Minimum weight, present, determined by size of car used; proposed, when a carrier cannot furnish car of the capacity or dimensions ordered by shipper, after six full days' notice therefor has been given by the shipper, and for its own convenience furnishes car of greater capacity than the one ordered by shipper, it will be used on the basis of the minimum carload weight fixed in tariff or classification to apply on size of car ordered by shipper, but in no case less than the actual weight, provided the shipment could have been loaded upon or in a car of the size ordered.

I. C. C. Decisions

25557. Cement. North American Cement Corporation vs. N. Y. C. et al. By Division 3. Rate, Alsen, N. Y. to Harlem River Transfer, N. Y., unreasonable to the extent it exceeded or may exceed 12.5c. New rate to be made effective not later than Aug. 31, prescribed and reparation awarded. Addition of emergency charge authorized.

No. 17789. Sand and Gravel. Missouri Gravel Co. vs. C. B. & Q. et al. and No. 20714, same vs. C. B. & Q. Order entered in 20714 on July 7, 1930, is vacated and set aside; it is further ordered, that that portion of the order entered in 17789 on October 15, 1927, which by its terms requires defendants Chicago, Burlington & Quincy Railroad Co. and Wabash Railway Co. to maintain a rate not in excess of 88c per net ton on sand and gravel, in carloads, from La Grange, Mo., to Jacksonville, Ill., and intermediate destinations on the latter carrier east of Clayton and Hadley, Ill., be, and it is hereby, vacated and set aside as of August 19, 1933, and that said defendants are notified and required to establish on or before August 19, 1933, upon notice to this commission and to the general public by not less than 30 days' filing and posting in the manner prescribed in Section 6 of the interstate commerce act, and thereafter to maintain and apply to this traffic from and to the points named in this paragraph, rates which shall not exceed 101c per net ton; provided that to the rates herein prescribed may be added the present authorized emergency charges; and, it is further ordered, that, except as herein modified, the said orders of Oct. 15, 1927, and Dec. 15, 1931, in No. 17789, shall remain in full force and effect.

15002. Cement. Cement from Louisville, Neb. By division 2. By Fourth Section Order No. 11259 applicants having circuitous routes authorized to establish rates on portland or hydraulic cement from Louisville, Neb., to destinations in Minnesota, North Dakota and South Dakota, the same as the rates contemporaneously in effect on like traffic over the short line or routes from and to those points, constructed on the basis prescribed or approved in Ash Grove Lime & P. C. Co. vs. C. B. & Q., 190 I. C. C. 103, which report is hereby referred to and made a part hereof and to maintain higher rates from and to intermediate points; provided, that rates from and to higher rated intermediate points shall not exceed rates constructed on the basis prescribed or approved in that proceeding and shall in no case exceed the lowest combination of rates subject to the interstate commerce act; provided further, that the authority granted shall not include intermediate points as to which the haul of the petitioning line or route is not longer than that of the direct line or route between competitive points, and that the relief authorized shall not apply over lines or routes which are more than 50% longer than the short line or route from and to the same points; further ordered that in complying with the foregoing conditions carriers may use distances from and to base points in lieu of distances from and to individual points.

14472. Crushed Stone. Dolese Brothers Co., et al. vs. A. T. & S. F. et al.; No. 16963, Automatic Gravel Products Co. et al. vs. C. R. I. & P. et al.; 17789, Missouri Gravel Co. vs. C. B. & Q. et al., and 20714, Same vs. Same. New rates effective not later than Aug. 19, on crushed stone from Buffalo and Linwood, Ia., and on sand and gravel from Muscatine, Ia. to LaGrange, Mo., to destinations in Illinois. Findings modify prior reports in 14472, 89 I. C. C. 110, 128 I. C. C. 471, in 16963, 126 I. C. C. 487, and 17789, 132 I. C. C. 200. Findings and order in the prior reports in No. 20714, 152 I. C. C. 561, 167 I. C. C. 1, with respect to the rate for the future on sand and gravel from Louisiana, Mo., to Quincy, Ill., has been vacated and set aside.

The new rates prescribed in Nos. 14472 and 17789, stated in cents a net ton, follow:

	Rate (Cents)
From Buffalo and Linwood, Iowa—	
In connection with the Burling to—	
Altona, Monmouth, Cameron, Gales Farm, Galesburg, Alexis, Gerlaw, Ill.	90
Arpee, Walton, Burnside Crossing, Kirkwood, New Boston, Green Oak, Keithsburg, Amboy, London Mills, Douglas, Biggsville, Zearing, Daggetts, Malden, Gladstone, Chadwich, Princeton, and Milledgeville, Ill.	113
Lomax, Dallas City, Tennessee, Lee, Dallas Hill Siding, Colusa, Sepo, Colmar, Serena, Ray, Steward, Adrian, Blakes, Wedron, West Havana, Bader, Oregon, Plymouth, Ferris, Rochelle, Dayton, Honey Creek, Augusta, Browning, Rushville, Carthage, Flag Center, Chana, Ottawa, Frederick, Richards, La Prairie, Basco, Golden, Beardstown, and Grand Ridge, Ill.	120
Merritt, Riggston, Winchester, and Alsey, Ill.	12[illegible]
In connection with the New York Central to—	
Zearing-Ladd, Ill., inclusive	113
In connection with the Rock Island Southern to—	
Monmouth, Cameron and Galesburg, Ill.	90
In connection with the Minneapolis to—	
Keithsburg, Ogle, Seaton, Little York, Eleanor, and Monmouth, Ill.	90
Nemo, Ill.	101
Destinations east of Abingdon, Ill.	113
In connection with Toledo to—	
Orchard Mines—Canton, Ill., inclusive	113
Scottsburg-Ferris, Ill., inclusive	120
McCall-Warsaw, Ill., inclusive	126
From La Grange, Mo.—	
In connection with the Toledo to—	
Burnside-Good Hope, Ill., inclusive.	101
New Philadelphia-Civer, Ill., inclusive	113
In connection with the Wabash to—	
Jacksonville, Ill., and intermediate destinations east of Clayton and Hadley, Ill.	101

The commission further finds that the rates in issue in 16963 on sand and gravel, in carloads, from Muscatine, Iowa, to destinations in western Illinois should be made 10c over the rates herein prescribed or approved from Buffalo and Linwood, Iowa, except to destinations on the Minneapolis, Farmington, Ill., and west thereof, to which the rates from Muscatine

should be made the same as from Buffalo and Linwood. To the rates prescribed or approved herein may be added the present authorized emergency charges.

148843. Sand and Gravel. By division 2. Authority granted to establish and maintain rate of 75c per net ton, C. L., from Mason City, Iowa, to Albert Lea, Minn., without observing the long and short haul provision of Section 4.

No. 25294. Slag. Cash Brothers, Inc., vs. N. Y. N. H. & H. et al. and four subnumbers thereunder, Connecticut Roofing Co. vs. Same, J. J. Moreau & Son vs. B. & M. et al., Glennon Roofing Co. vs. N. Y. N. H. & H. et al. and E H. Friedrich Co. vs. Same. By division 4. Rates, slag, points in eastern Pennsylvania to destinations in Massachusetts, Connecticut, and New Hampshire, unreasonable to the extent they exceeded the rates under scale B prescribed in National Slag Co. vs. Atlantic City Railroad, 181 I. C. C. 699, subject to the addition of 70c a ton for carfloat or lighterage service in New York Harbor and to the conditions set forth in the National Slag case with reference to computing distances. Reparation awarded. Commissioner Mahaffie dissented.

25059. Asphaltic Limestone. Alabama Asphaltic Limestone Co. vs. Akron and Braberton Belt et al. By division 5. Rates from Margerum, Ala., to points in official territory found not unreasonable. Rates found unreasonable, however, on asphaltic limestone to which asphalt has been artificially added, to the extent they exceeded, or may exceed, rates under the scales and in the manner prescribed in Interstate Amiesite Co. vs. A. & R., 172 I. C. C. 100 for application between southern territory points at the rate of 10c a ton for each additional distance of 40 miles over 1,000 miles. New rates to be issued not later than Sept. 7. Reparation denied.

25407. Sand and Gravel. Reed & Wheelock vs. C. B. & Q. and a sub number thereunder, Same vs. Same. By Examiner Charles W. Berry. Rate, sand and gravel, Oreapolis, Neb., to Prescott, Ia., not unreasonable. Rate to Bedford, Ia., not unreasonable in the past but proposed to be found unreasonable for the future to the extent it may exceed $1.15 a ton. Reparation proposed to be denied.

24987. Plaster Retarder Combinations. With five of its ten members writing or joining in separate expressions, the Commission, in No. 24987, Standard Gypsum Co., Inc., et al. vs. A. T. & S. F. et al., a case involving aggregates of intermediate lower than the joint rates, has found that the rates on plaster retarder, carloads, from McCook, Ill., to Los Angeles, Calif., prior to October 30, 1931, and to Long Beach, Calif, prior to October 5, 1931, were unreasonable and has awarded reparation. Present rates to the points mentioned, and the past and present rates to Ludwig, Nev., have been found not unreasonable. The dates mentioned are those on which the carriers changed the rates which caused the controversy.

The finding, other than the one concerning the rates to Ludwig, was that the failure of the defendants to publish and apply the rates of 80.5c. maintained prior to October 5, 1931, and $1.14 from October 5 to October 30, 1931, to Los Angeles; and 87.5c. prior to June 15, 1930, and 86.5c. from June 15, 1930, to October 5, 1931, to Long Beach was unjust and unreasonable and resulted in damages to complainants in the amounts of the differences between the charges collected on their shipments in those periods and those which would have accrued at the rates before named, and that they were entitled to reparation, with interest.

24800. Fuller's Earth. Gulf Refining Co. vs. B. S. L. & W. et al. Rate, fuller's earth, Quincy, Midway and Jamieson, Fla., and Aattapulgas, Ga., to Port Arthur and West Port Arthur, Tex., unreasonable prior to Oct. 1, 1932, when a rate of $7.20 a net ton was established, to the extent it exceeded $7.40, minimum, 60,000 lbs., prior to Jan. 4, 1932; and to the extent it exceeded the same rate plus the authorized emergency charge on and after the latter date.

25327. Molding Sand. Creamery Package Co. vs. B. & M. et al. Rate, molding sand, Schuylerville, N. Y., to Ft. Atkinson, Wis., found inapplicable. Applicable rate, 24c. Reparation awarded.

24850. Sand and Gravel. B. G. Coon Construction Co. vs. Pennsylvania et al. Rate, sand and gravel, Carpenterville, N. J., to Sandt's Eddy, Penn., unreasonable to extent it exceeds 80c. a ton. Reparation awarded.

25349. Molding Sand. Allen Manufacturing Co. et al vs. L. & N. Dismissed. Rate from Indiana and Ohio to Nashville and Franklin, Tenn., inapplicable and unreasonable.

24717. Cement. Southern Cement Co. vs. A. G. S. et al. Rates, North Birmingham, Ala., to destinations in official territory and Wisconsin and to points in Iowa and Missouri on the west bank of the Mississippi River, not unreasonable, on shipments that moved in accordance with shipper's routing instructions. Seven cars found to have been misrouted. On shipments to Flint, Mich., Princeton, N. J., and Meadville and Safe Harbor, Penn., the Commission found that the applicable rates were 28, 47, 29 and 30.5c. respectively. Complainant directed to submit Rule V statements and submit in connection therewith any information available as to the carrier or carriers that were responsible for the misrouting in the report and as to the rates charged from North Birmingham to Safe Harbor in 1931.

22906. Fuller's Earth Adjustment. Barnsdall Refineries, Inc., vs. Midland Valley et al. and cases joined with it, on findings of unreasonableness, has directed readjustment of rates on fuller's earth from points in Georgia and Florida to petroleum refining points in Texas, Oklahoma, Kansas, Iowa and Nebraska not later than May 25. It also awarded reparation.

Reparation was awarded to complainants other than in No. 23060, Root Refining Co. vs. M. & O. et al. Commissioners Lee and Mahaffie noted a general dissent.

This report embraces, in addition to the cases hereinbefore mentioned, two subnumbers to the title complaint, Mid-Continent Petroleum Corp. vs. S. A. L. et al., and Champlin Refining Co. vs. Atlanta & St. Andrews Bay et al.; No. 23471, White Eagle Oil Co. vs. C. R. I. & P. et al.; No. 24151, Sinclair Refining Co. vs. A. T. & S. F. et al., and No. 24622, Mona Motor Oil vs. C. B. & Q. et al.

14344. Ground Limestone Fourth Section. Ground limestone from Falling Spring, Va., to the south. Supplemental report. Relief granted, in second supplemental fourth section order No. 10595, from the long and short haul part of section 4, on marl from Falling Spring, Va., to points in the south by including it in the relief granted on ground limestone in a modification of the original report, 186 I. C. C. 316.

24456. Agricultural Lime. Bone Dry Fertilizer Co., Inc., vs. A. C. L. et al. Upon reconsideration finding in the original report, 186 I. C. C. 124, that rates, agricultural lime, Berkeley, W. Va., to Virginia destinations were unreasonable, affirmed.

Proposed I. C. C. Decision

No. 25571. Lime. Rockdale Lime Co., Inc., vs. B. & O. et al. By Examiner C. J. Peterson. Dismissal proposed. Rates, lime Strasburg Junction and Linville, Va., to Charleston and South Charleston, W. Va., proposed to be found not unreasonable.

Asks Sand Rate Change

FIFTEEN railroads, the Detroit, Toledo and Ironton Railroad Co., in particular, are named defendants in a complaint just filed with the Interstate Commerce Commission by the Akron (Ohio) Chamber of Commerce on behalf of the Columbia Silica Co.

The specific rate in question is that of 179c per ton on sand, in carloads, from Jackson, Ohio, to Detroit, Mich. Violation of Sections 2 and 3 are alleged. Columbia Silica Co. shipments from Akron compete with those of the Ohio Quartz Products Co. from Jackson, Ohio.

Rail vs. Truck Rates

THE Baker Sand & Gravel Co., which operates the Baker Towboat Co., Demopolis, Ala., has appealed to the state public service commission in its effort to prevent reduction of sand and gravel rail rates from Selma to Eutaw, Ala.

A reduction from 90 to 71c per ton to meet truck and boat line competition is sought by the Southern Railroad. Favoring the railroad's petition are sand and gravel interests at Selma, as without a rate reduction they cannot compete successfully with the Baker company which delivers its sand from Warrior River dredges direct to trucks bound for Eutaw.

Seek Sand-Gravel Rate Cut

TWO CARRIERS have filed petitions with the Nebraska railway commission for reduction of sand and gravel rates. The Omaha Railroad has asked for authority to cut its rates from Brockman Spur to Hartington, Laurel, Fordyce, Concord, Wausa and Bloomfield, an average of ½c per 100 lb.

Authority to establish a rate of 45c on sand and gravel shipments from Brockman Spur to Lyons. A similar rate from Columbus to Humphrey is sought by the Union Pacific.

Complainants Denied Damages

Blasting Operations of Federal Crushed Stone Corp., Buffalo, N. Y., Are Properly Conducted

A COURT DECISION of interest and value to all quarry operators was handed down, June 1, by Judge Harris in the Supreme Court, County of Erie, New York State, in the case of Florence Barrett and Adelaide Gisman, plaintiffs, and the Federal Crushed Stone Corp., defendants. The decision is given complete as follows:

"In this action brought and tried in equity, the plaintiffs, on the theory of nuisance, seek to recover damage from the defendant for injury which the plaintiffs claim was done to their premises by reason of the operations of the defendant in quarrying. The premises of the plaintiffs are situated on the north side of Bennett Road in the Town of Cheektowaga, Erie County, N. Y., and contain about an acre of land on which there is located a large three-story building used as a hotel. The building, substantial in type, was erected about the year 1898 and the additions thereto were made in the year 1900. Subsequently thereto and from time to time, certain improvements and repairs were made to such building.

"In May, 1928, the Town Board of Cheektowaga gave to the Cheektowaga Crushed Stone Corp. (the earlier corporate name of the defendant herein) a permit to construct and to operate a plant for quarrying and crushing rock on its lands about 2,000 ft. north of Bennett Road, east of Union Road and west of Indian Road in the said town and such permit was granted and on the 10th day of May, 1928, was accepted by the defendant, on the express condition that no nuisance should be caused or permitted in and about the construction and operation of such plant, the quarrying, crushing or handling of stone thereabouts, and that no dust should be permitted to escape the premises.

"The defendant commenced blasting operations in April, 1929. The premises on which the blasting was and has been conducted had formerly been used by the Lehigh Valley Railroad for the storage and loading of coal in very large quantities. On adjoining premises, there had been at one time a large plant for making scrap from freight cars. Next to the premises of the defendant are two large bituminous plants and in the vicinity of the premises of both parties hereto and at varying distances of half a mile to one and one-half miles are the main trackages of the important railroad companies entering Buffalo from the east and yards incident to the operations of such railroad companies. The territories surrounding the City of Buffalo which is not far distant from the premises in question, and particularly that part surrounding such premises, contain vast tracts of stone so placed as to be suitable for quarrying. For generations the business of quarrying has been conducted in and about Buffalo and to the east thereof. The premises of the parties are included in a hamlet known as Bellevue, originally planned as a home section for those engaged in industry in the vicinity. A group of dwellings and business establishments have been developed there; but it must be said that the surrounding territory, as above described, is of such a nature that such territory including Bellevue can be regarded as devoted to the purposes of industry and commerce.

"Shortly after the establishment of the work of the defendant, Mrs. Barrett, one of the plaintiffs, complained to the defendant about the blasting in the quarry and what she claimed were the consequences thereof on the premises of the plaintiffs. The blasting continued and the complaints continued and resulted in the bringing of this action.

"The plaintiffs claim that in two ways the blasting has caused damage to their premises. One claim is that stones have been shot through the air and have landed on the premises of the plaintiff and that stone dust has drifted through the air on to such premises. The amount of damage claimed from this cause is so negligible that if there is to be a recovery herein by the plaintiffs, such recovery could not well include damage from this cause.

"The other damage claimed is attributed to vibrations from the quarry blasting coming through the surrounding earth and shaking and causing damage to the building of the plaintiffs. On this question, much proof was presented by both plaintiffs and defendant. The plaintiffs gave testimony tending to establish damage from such a cause but the proof presented by witnesses on behalf of the defendant who saw the plaintiffs' premises in 1929 and described conditions which they said then existed and which the plaintiffs claim came in later years, and the testimony of numbers of neighbors who claim that no similar damage was done to their premises in territory contiguous to the quarry lands lead me to the conclusion that the plaintiffs have not established by a fair preponderance of evidence the fact of injury to their premises by vibration. I am of the opinion that such variations from construction as now exist in the premises such as cracked cellar and foundation walls and so called distortions of interior walls, if they do exist, did exist prior to the operations of the defendant and from causes other than defendant's operations.

"However, if vibration had caused the damage complained of by the plaintiffs, there then comes the question as to whether or not a cause of action would lie against the defendant on account of such injury by vibration to the structure. I am convinced by the proof herein that the operations of the defendant have been conducted with the utmost care and in strict accordance with the most improved methods of quarrying. With the facts established as to the industrial and commercial use of the territory and as to the manner of operation by defendant, in my opinion the defendant would not be liable to the plaintiffs for damage necessarily coming from the vibrations set in force in its plant. It would only be liable if it did not use the most approved up to date methods or if it made an unreasonable use of its property. (McCarty vs. Natural Carbonic Gas Co., 189 N. Y. p. 40; Page vs. Dempsey, 184 N. Y. 245; Booth vs. The Rome, Watertown & Ogdensburg R. R. Co., 140 N. Y. *267*; Stevenson vs. Pucci, 32 Misc. Rep. 464; Hill vs. Schneider, et al., 13 A. D. 299.)

"The defendant is entitled to judgment dismissing the complaint herein."

Sand-Lime Brick Production and Shipments in May

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Fifteen sand-lime brick plants reported for the month of May, this number being three more than the number reporting for the month of April, statistics for which were published May 25:

Average Prices for May

Shipping point	Plant price	Delivered
Medfield, Mass.	$ 8.00	$9.00-$10.00
Flint, Mich.	11.50	13.00
Detroit, Mich.	....	10.50
Madison, Wis.	13.50	12.50
Mishawaka, Ind.	9.00	....
Detroit, Mich.	10.50	11.50
Grand Rapids, Mich.	....	12.50
Minneapolis, Minn.	6.50	7.50
Syracuse, N. Y.	16.00	18.00
Saginaw, Mich.	10.00	....
Dayton, Ohio	9.00	10.00
Toronto, Ont., Can.	12.00	13.50

Statistics for April and May

	†April	*May
Production	492,000	587,535
Shipments (rail)	50,000	71,500
Shipments (truck)	742,275	605,610
Stocks on hand	3,003,093	3,876,987
Unfilled orders	2,775,000	1,580,000

†Twelve plants reporting; incomplete, seven not reporting unfilled orders.

*Fifteen plants reporting; incomplete, four not reporting unfilled orders.

Digest of Foreign Literature

By F. O. Anderegg, Ph. D.
Consulting Specialist, Pittsburgh, Pa.

International Dictionary of Cement. C. R. Platzman completes the list of cement terms in English, French, German and Spanish (Cf. Rock Products, May, 1933, p. 40) and proposes to publish them in dictionary form. *Cement and Cement Manufacture* (1933), V. 6, No. 4, pp. 127-130; No. 5, pp. 181-185.

Refractory Material for Cement Rotary Kilns. J. Fauner discusses the effect of mechanical wear, thermal effects and chemical attack on refractories for cement kilns. The first is very important, especially in the upper part of the kiln, so that considerable attention must be given to the abrasion resistance of the block. The second is important only when starting and stopping the kiln and may be minimized by allowing sufficient time for heating or cooling.

The chemical attack occurs almost entirely at the higher temperatures and is more pronounced as the clinkering zone is approached. In the cooler zone, under strongly reducing conditions, carbon monoxide attacks the iron in the blocks. Also in the hottest zone a strongly reducing flame distills off silica and alkali, which are condensed in a cooler part of the kiln with formation of slag. In addition to the alkalies, iron and manganese contribute to any slagging action and fluorspar, if present, is very bad, even at 1,000 deg. C. With a poor refractory, the presence of slag increases the abrasive action considerably, while a thick layer of slag renders the blocks sensitive to temperature change. The lime in the raw mix is a powerful flux, but the softening of the surface allows the clinker and raw meal to adhere to it with an appreciable protective action.

The most satisfactory method of lining the kiln is to lay the block in without mortar, but they must fit properly. Diaspore has given good results in North America, while the Corhart "Electrocast" for the clinkering zone "almost eliminates kiln lining difficulties." But brick of lower alumina content have been successfully used, eg. 73% SiO_2 and 24% Al_2O_3, when of proper structure and when the kiln is properly operated. *Cement and Cement Manufacture* (1933), V. 6, No. 4, pp. 113-123.

Volume Changes in Concrete with Different Aggregates. Prof. Otto Graf of Stuttgart describes the results of observing the changes produced by alternate wetting and drying of concrete and finds that the elasticity of the aggregate is a factor. When the stone shows little tendency to give under load, the volume changes in concrete caused by moisture changes are reduced. The expansivity of the concrete, as controlled largely by the aggregate, seems to be an important factor in determining the development of shrinkage cracks. *Beton and Eisen* (1933), V. 32, No. 7/8, pp. 121-123.

The Hardening and Corrosion of Portland Cement IV. The Electrical Conductivity of Setting Cements. Dr. Karl E. Dorsch of Karlsruhe, Germany, describes a method of determining electrical conductivities of setting cements which involves a valve oscillator set-up. The paste at a definite temperature is placed in an ebonite cell provided with platinum-coated brass electrodes. The electrodes are screwed into position so that the distance is constant and the contact with the paste is complete. The cell is maintained in a thermostat for many hours.

In general, the higher the lime content of the cement and the water content of the paste, the higher the conductivity. Portland cements were found to have greatest conductivities, then blast furnace cements, while aluminous cements were lowest. The curves for a given cement with different amounts of water added were generally parallel. The temperature had a marked effect on the course of the curve; the higher the temperature, the greater the conductivity at first, but the more rapid the drop, so that the higher temperatures curves generally crossed over those obtained at lower temperatures. The same thing holds for the reaction rates of cements, those having greatest reactivity producing a maximum conductivity quite soon, followed by a rapid drop.

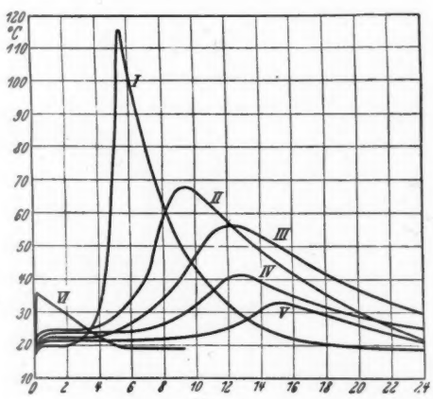


Chart showing relation of temperature to conductivity of setting cements

The Hardening and Corrosion of Cement V. The Setting Temperatures of Different Cements. Dr. Karl E. Dorsch continues the study of various cements during the setting and hardening reaction by observing temperatures of the paste in a Dewar flask. His results are shown on the accompanying chart.

Some experiments were made on the *solubility of portland cement in water* by shaking 50 grams with one liter of water at 18 deg. C. and removing portions at intervals for analysis. The silica, alumina, iron oxide and magnesia were dissolved but slightly, the amount varying little with the time of shaking. The lime content, which varied with the amount in the cement, rose rapidly to a maximum in about eight hours, and at about the point of highest temperature. After this the lime in solution gradually dropped. Lime dissolves to a much greater extent in the presence of cement than in its absence.

The resistance of cements to attack by aggressive solutions depends upon a variety of factors which will be briefly discussed: (1) The chemical nature of the cement, with lime and alumina content being most important is the first to be considered. Even a difference between 63 and 65% lime may have some effect. The nature of the raw materials and the intensity of burning must also be considered as well as the period of storage of the cement. Chemical analyses alone fail to tell the story. (2) Fineness, generally by exposing more surface, might be expected to provide more opportunity for contact. (3) Admixtures may influence the results. (4) In the opinion of the reviewer, density and porosity are together a very important factor in determining corrosion resistance, and often completely outweigh factor (2). If the size distribution is such that a very compact fit among the particles is obtained, the opportunity for contact of aggressive solutions with the cement may be very greatly reduced. (5) Water-cement ratio is important in that an excess leaves an open structure which is readily penetrated. The author proposes to use distilled water only in his experiments because of the variable effects of different tap waters. (6) Treatment of the cement just after mixing, including the effect of temperature and opportunity for evaporation during storage affect the resistance to corrosion; for instance, specimens cured in moist air seem to be most resistant. (7) The length of storage must be considered, the resistance increasing with the storage period. (8) The nature of the attacking solution determines the degree of corrosion; those anions which form the more soluble salts with lime seem to be most corrosive. (9) Concentration and amount of aggressive solutions; those solutions containing most attacking agents being most harmful. (10) Surface and size of test pieces. (11) The

temperature of the attacking solution as determining reaction rates and solubilities. In this connection, the reviewer suggests the manner in which the temperature may change, as controlling the rate and amount of growth of crystals within the specimens, has important bearing on resistance of corrosive solutions. (12) The storage conditions including vibration, stirring, etc. The literature is full of apparently contradictory results because of failures to note and control some of these important variable factors. *Cement and Cement Manufacture* (1933). V. 6, No. 5, pp. 171-178.

False Set of Cement. F. Whitworth objects to certain conclusions reached by Schachtschable (Cf. ROCK PRODUCTS, January, 1933, p. 38) in regard to the effect of the amount of mixing water on the initial set. W. heated a cement containing 2.5% SO_3 to 115 deg. C. (239 deg. F.) to change it completely to hemihydrate and found that variations in mixing water from 25 to 40% increased the initial setting from five only to eight minutes. This set he ascribed to the recrystallization of the hemihydrate into gypsum, the crystals interlocking with sufficient bond to register an initial set by the needle tests unless the mixing water is very high. The hemihydrate content must exceed 1% equivalent of SO_3 to produce a false set. On heating a cement containing 2% SO_3 to 550 deg., where the second soluble form of anhydrite, "estrich gyps," is formed, the setting is normal, but when heated between 200 and 450 deg., W. obtained a complete rapid set. A distinction should be made between false and rapid setting. The former is accompanied with little temperature rise, while the latter is. In observing false set, it is important to gage with all possible speed. *Cement and Cement Manufacture* (1933). V. 6, No. 5, pp. 179-180.

Comment: In the grinding of and during the silo storage at temperatures above 150 deg. F. of portland cement practically all the gypsum has had plenty of opportunity to change to hemihydrate.

Formulas for the Control of Air Separation. A. B. Helbig points out that with ordinary air separators the capacity is very greatly reduced as the product becomes finer, for instance separation at 20 microns reduces the output to about one-sixth over a product having a 10% residue on a 70-mesh screen. This disadvantage led to the invention of a new separator which will shortly be on the market.

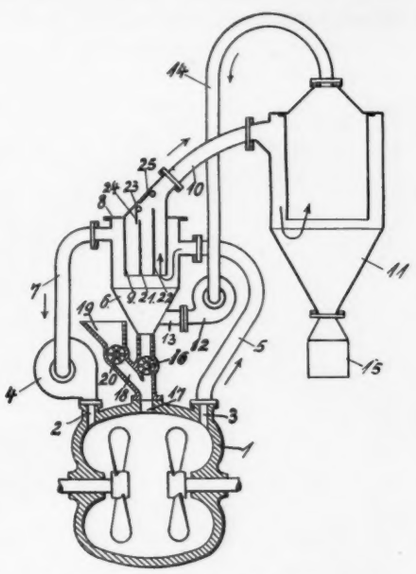
In order to control successfully the air separator, it is necessary to sample very carefully both the coarse and fine products of the separator and sieve them on a standard sieve. It is important to know the amount of abrasion which occurs during the separation, which may be either crushing or attrition of the particles, rubbing off fines clinging to the larger particles, or breaking up clumps of fine particles. This determination requires the weights of the two separator products, which may be difficult to get, so it is proposed to secure the average for the machine for future use. Then with a given screen, it is possible to calculate the efficiency of the separation of the fine and of the coarse material.

Accurate adjustment of the present installations can only be made by carefully trained, skillful operators of long experience, but, it is claimed, the new machine permits adjustment without special knowledge of the plant. Formulas are derived for calculating efficiency. *Cement and Cement Manufacture* (1933) V. 6, No. 44, pp. 124-126.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

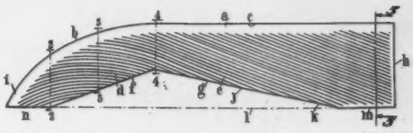
Air Separation Process. This is a process of grinding with air separation. The mill (1) appears to contain two propellors. Air is forced into it from the pump (4) and escapes through the passage (3) carrying a mixture of ground and partially ground material. This goes to a fore separator which can be regulated to give the size of product



Grinding unit with air separation system

required, the coarser residue going into a hopper from which it is returned to the mill by a revolving feeder (16). The fine product goes to the cyclone (11) where the greater part is caught. Any dust which escapes goes to the suction fan of the cyclone (12), and back into the separating system. That part of the air that does not go to the cyclone returns to the pump (4) and hence the whole system is in close circuit.—*E. Kramer (Germany), Assignor to Hartstoff Aktiengesellschaft, Berlin-Copenick, Germany. U. S. Patent No.* 1,846,209.

Separation of Dry Materials. This patent is for a peculiar form of dry concentrator. The feed and concentrating sections are on either side of the line 4-4. The feed section has straight riffles and the concentrating section has curved riffles as shown. The table was designed especially for the dry cleaning of coal.—*K. C. Appleyard et al, assignors of one-fourth to Birtley Iron Works, Ltd., Birtley, England, U. S Patent No.* 1,876,825.



Riffle design for coal dry-cleaning unit

Composite Structural Material. The invention is a combination of a stone-like outer layer and a fibrous, non-heat-conducting and non-sound-conducting inner layer of mineral or vegetable fiber or both. The stone-like layer is of "Rostone," a composition previously patented by the inventors, consisting of slate or shale mixed with lime, magnesia or other earth base mixed with the right amount of water for complete reaction and heated. The principal use of such material is for making the floors, walls and ceilings of buildings, according to the inventors.—*D. E. Ross, F. P. Wymer and R. L. Harrison, assignor to Rostone, Inc., Lafayette, Ind., U. S. Patent No.* 1,852,676.

Separating Particles of Different Densities by Means of Liquids. This is an improvement on the "float and sink" method of separating minerals, at present only used as a laboratory method. It consists of spraying the materials to be separated with a light oil which reduces the amount which the surfaces are wetted by the expensive heavy solution. Solutions of lead acetate and zinc chloride, both commonly used in laboratory testing, are mentioned as suitable.—*C. W. H. Holmes, assignor of one-half to Birtley Iron Works, Ltd., Birtley, England, U. S. Patent No.* 1,871,121

Aluminous Cement with an Iron Alloy. Bauxite containing iron is melted with limestone and phospherite, preferred proportions being 47%, [illegible] and 8% respectively. Charcoal, coke or the like is added as a reducer. The required temperature is said to be 1100 deg. C. and at this point the melted cement and the iron-phosphorous alloy separate.—*Leonce de Lambert (France), assignor of one-half to Pierre Zucco, San Francisco, Calif., U. S. Patent No.* 1,834,770. [Pierre Lucco recently put up a plant for making aluminous cement in Los Angeles, Calif.—THE EDITOR.]

Rock Products Industries Busy Developing Codes

THE National Lime Association is apparently the first in the rock products field to have a code ready to submit to the entire industry. The trade relations committee of the association has been busy for several months drafting and redrafting a code to eliminate unfair trade practices, to meet the requirements of the new National Industrial Recovery Act.

Lime Industry to Meet June 28

This code is now ready to submit to a conference of the entire industry, which has been called to take place at the Haddon-Hall hotel, Atlantic City, June 28, at 10 a. m. The conference will be followed by a two-day annual convention of the National Lime Association, to which all lime manufacturers are invited.

At the conference, all lime manufacturers will have an opportunity to discuss the various provisions of the code and to offer suggestions for its further improvement. After final adoption by the industry, the code of fair competition will be submitted to the President of the United States for approval as provided under the Act.

The members of the Trade Relations Committee of the National Lime Association are: B. L. McNulty, Marblehead Lime Co., Chicago, Ill., (Chairman); F. C. Cheney, Cheney Lime & Cement Co., Birmingham, Ala.; Cecil R. Haden, Haden Lime Co., Houston, Tex.; Henry LaLiberte, Cutler-Magner Co., Duluth, Minn.; C. C. Loomis, New England Lime Co., Adams, Mass.; John S. McMillin, Roche Harbor Lime & Cement Co., Roche Harbor, Wash.; James H. McNamara, Eagle Rock Lime Co., Eagle Rock, Va.; Ray C. Noll, Whiterock Quarries, Inc., Bellefonte, Penn.; J. F. Pollock, Ash Grove Lime & Portland Cement Co., Kansas City, Mo.; S. Walter Stauffer, J. E. Baker Company, York, Penn.; George J. Whelan, the Kelley Island Lime & Transport Co., Cleveland, Ohio; Gordon Willis, Hunkins-Willis Lime & Cement Co., St. Louis, Mo.

Aggregate Industries Work on Common Code

On June 1 and 2 the executive committees of the National Slag, National Crushed Stone and National Sand and Gravel Associations met in Washington, D. C., and agreed to submit a common code to cover all three industries. Much work was done in getting the code into tentative form to submit to the industries for their approval some time in the near future.

The members of the National Slag Association committee at the meeting were: C. L. McKenzie, Duquesne Slag Products Co., Pittsburgh, Penn., chairman; C. E. Ireland, Birmingham Slag Co., Birmingham, Ala.; H. N. Snyder, Buffalo Slag Co., Buffalo, N. Y.; W. E. Kilcawley, Standard Slag Co., Youngstown, Ohio; H. J. Love, secretary of the association, Cleveland, Ohio.

Present at the meeting representing the National Crushed Stone Association were A. L. Worthen, Connecticut Quarries Co., New Haven, Conn., chairman; W. M. Andrews, New Castle Lime and Stone Co., Youngstown, Ohio; F. T. Gucker, John T. Dyer Quarry Co., Norristown, Penn.; Otho M. Graves, General Crushed Stone Co., Easton, Penn.; E. J. Krause, Columbia Quarry Co., St. Louis, Mo.; Russell Rarey, Marble Cliff Quarries Co., Columbus, Ohio.; W. R. Sanborn, Lehigh Stone Co., Kankakee, Ill.; T. I. Weston, Weston and Brooker Co., Columbia, S. C.; A. J. Wilson, Granite Rock Co., Watsonville, Calif.; J. R. Boyd, secretary, and A. T. Goldbeck, director of the bureau of engineering, of the Association.

The National Sand and Gravel Association and the National Ready Mixed Concrete Association made their executive committee meetings an open meeting to which all members of the association were invited. Those present were:

Adler, Julius, Eastern Sand and Gravel Corp., Philadelphia, Penn.
Ahearn, V. P., National Sand and Gravel Association, Washington, D. C.
Avril, A. C., Avril-Tru-Batch Concrete, Inc., Cincinnati, Ohio.
Behrle, Leo, Chicago Gravel Co., Chicago, Ill.
Bird, Paul P., Boston Sand and Gravel Co., Cambridge, Mass.
Bowker, J. E., Western Massachusetts Sand and Gravel Co., Westfield, Mass.
Cooley, C. G., Cooley Gravel Co., Chillicothe, Mo.
Coppock, F. W., American Aggregates Corp., Greenville, Ohio.
Curtis, H. F., Curtis & Hill Gravel and Sand Co., Philadelphia, Penn.
Dann, Alex. W., Keystone Sand and Supply Co., Pittsburgh, Penn.
Davison, H. S., J. K. Davison & Bro., Pittsburgh, Penn.
Ellingen, O. J., H. D. Conkey and Co., Mendota, Ill.
Fletcher, R. C., Flint Crushed Gravel Co., Iowa Limestone Co., Standard Gravel Co. (also representing Iowa Aggregates Association, Des Moines, Ia.).
Foster, Alex., Jr., Warner Co., Philadelphia, Penn.
Gehrsten, Alex., Ready Mixed Concrete Co., Reading, Penn.
Haddow, Hugh, Jr., Menantico Sand and Gravel Co., Millville, N. J.
Johnston, V. O., the Lincoln Sand and Gravel Co., Lincoln Lakes Co., Lincoln, Ill.
Klein, W. H., Dixie Sand and Gravel Corp., Chattanooga, Tenn.
McCue, T. P., Curtis & Hill Gravel and Sand Co., Philadelphia, Penn.
McGrath, T. E., McGrath Sand and Gravel Co., Lincoln, Ill.
Mayer, J. G., Erie Sand and Gravel Co., Nickel Plate Sand and Gravel Co., Erie, Penn.
Owens, H. V., Eastern Rock Products, Inc. (President, National Sand and Gravel Association), Utica, N. Y.
Peck, Frank W., Peck-Thompson Sand and Material Co., Kansas City, Mo.
Pelsue, Garvin, Graham Brothers, Inc. (also representing Southern California Rock Products Association), Long Beach, Calif.
Prince, John, Stewart Sand and Material Co. (also representing Missouri Aggregates Association), Kansas City, Mo.
Renwick, George W., Chicago Gravel Co., Chicago, Ill.
Richmond, J. L., Union Sand and Gravel Co. (also representing Ohio Valley Sand & Gravel Producers' Association), Huntington, W. Va.
Rockwood, Nathan C., Rock Products, Chicago, Ill.
Rogers, George A., Consolidated Rock Products Co., Los Angeles, Calif.
Ruffin, C. L., Massaponax Sand and Gravel Corp., Fredericksburg, Va.
Ruffin, C. L., Jr., Massaponax Sand and Gravel Corp., Fredericksburg, Va.
Sankey, John, Chicago Gravel Co. (also representing, as President, Illinois Sand and Gravel Association), Springfield, Ill.
Smith, H. T., Goodwin-Gallagher Sand and Gravel Corp., New York, N. Y.
Stepanian, Stephen, the Arrow Sand and Gravel Co. (also representing, as President, Ohio Sand and Gravel Producers' Association), Columbus, Ohio.
Sutton, E. Guy, Neal Gravel Co. (also representing Indiana Sand and Gravel Association), Mattoon, Ill.
Thomson, H. F., General Material Co. (President, National Ready Mixed Concrete Association), St. Louis, Mo.).
Twaits, F. J., Consolidated Rock Products Co., Los Angeles, Calif.
Walker, Stanton, National Sand and Gravel Association, Washington, D. C.
Warner, Charles, Warner Co., Philadelphia, Penn.
Warren, Ray V., Western Pennsylvania Sand and Gravel Association, Pittsburgh, Penn.

Gypsum

The Gypsum Association, Chicago, Ill., held a 2-day meeting in Chicago, the week of June 12, at which a tentative code was discussed in detail, and special committees were appointed to draft resolutions on each of the subjects assigned to them. Another general meeting is to be called in two or three weeks to discuss and adopt the code so drafted.

Cement

The Cement Institute, New York City, has had an admirable code for several years (see Rock Products, February 15, 1930). The Institute has received a new lease of life, the code is being revamped to meet the new law, and the portland cement industry is almost ready "to go." Trustees have been designated to submit the code to the member companies throughout the country. These trustees will meet in Chicago, June 27, and make a final draft of the code for submission to the President of the United States.

Administration of Public Works Billions

OFFICIALS of the Public Works Administration state no contracts for projects will be let in Washington, according to the *Wall Street Journal*. In its policy of decentralization, all work of the Administration will be done in the field, with the offices of Colonel Sawyer simply expressing final approval.

State and government agencies already in existence will pass on all projects. As the $3,300,000,000 provided in the act is allocated to various types of works it will be turned over to the proper agency for use. This is a decentralized organization with centralized control, an official of the organization said. The allotment for flood control, prevention of soil erosion, etc., will be turned over to the War Department, it was stated. The chief of engineers probably will have this work in charge.

Road Building Funds

The $400,000,000 for road construction will be assigned to the Agricultural Department's bureau of public roads for administration. This bureau will, in turn, divide the appropriation among the states, and contracting and building will be handled by state highway commissions.

Any grants to be provided for aid in railroad building will be passed upon by the Interstate Commerce Commission.

The act allows grants to cities for building projects. Field administrators will pass on these, contracts for buildings being let by individual cities.

The $50,000,000 specified in the act for forest and Indian reservation roads will be divided and turned over to Agriculture Department and Interior Department, respectively, for administration.

All of these agencies are decentralized. They will conduct their portion of the public works program through their own agencies, while the office of the administrator will keep in touch with their work and pass upon it.

Plans for Supervision

The personnel setup of Col. Sawyer's staff will include an official in charge of each branch of work to cooperate with the administrating agencies, it was said.

A member of the staff also will be appointed to administer the $25,000,000 provided for subsistence homesteads. Officials state they do not yet know how this will be handled. The section was added to the bill late and the preliminary work on organization has included little study of this section. It was learned at Col. Sawyer's offices that no formal appointments have yet been made of the 48 field administrators or of officials in the staff here. These appointments must be approved by the committee of cabinet officers set up by the President to advise with Col. Sawyer and Gen. Johnson, it was said. On the committee are Secretary Ickes, chairman, Secretaries Perkins and Roper and Attorney General Cummings.

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Another Letter to Mr. Secretary Ickes

THE FOLLOWING was published in the *Kansas City* (Mo.) *Retail Lumberman:*

Dear Mr. Ickes:

We see by the papers you've been thinking the "cement trust" ought to be investigated because of the prices you got on cement for the Boulder Dam. It certainly does our heart good to know we have finally got someone in Washington who believes in investigating everything.

Congress has been investigatin' the "cement trust" so regularly it's finally got to be a habit. I'm beginning to suspect there's a motto on the walls of the Senate and House Chambers reading something like this: "What is a Congress without a cement investigation?" Wouldn't something new be better to start off with?

Now we've got something that has been worrying us a long time and we think you ought to start an investigation on it. We've been borrowing money from banks a long time, Mr. Ickes, and in case you didn't know it, nearly all the banks want almost exactly the same rate of interest. It's a fact.

Tell you what you do. You start an investigation committee looking into interest rates because so far as we know no one has ever started anything like that and this interest trust has been working a long time. Just the other day I had to borrow $500 and I went to the First National, the Citizens State, the Home State and the National Bank of Podunk and doggone if every one of them didn't want exactly the same rate of interest. Now, Mr. Ickes, you just know there's collusion there and the government ought to prosecute those fellows.

And say, if you can find a dozen or so senators that would like to earn a little extra money on their expense accounts this summer, sic 'em on Big Jim Farley the big postoffice man. You know, those birds have been raising the price on postage when everything else has been going down. They charge you three cents to send a letter any place, whether it's three miles or three thousand. Now you know, Mr. Ickes, it isn't fair for the cement plants close to Boulder Dam to charge the same cement prices as the ones farther away, so, of course, it isn't fair for Big Jim Farley to charge the same for carrying a letter from New York to Los Angeles as from New York to Buffalo. You've got a good head on you, Mr. Ickes, and you can see that isn't fair.

While I'm writing you, I want to ask you to go around and meet a man who moved to Washington just a few weeks ago. He's sort of a stranger, probably, having been there only a few weeks, but you'll like him. He lives in a white house out on Pennsylvania avenue, someplace, I believe. I don't know his address, but someone can tell you where he lives. His name is Roosevelt.

This man Roosevelt has been doing a little lobbying in Congress trying to get the senators and representatives to agree to a let-up on some of the terms of the anti-trust laws, we hear. It's his idea that if manufacturers and distributors could sorta work together on production and distribution through associations, everyone could get better prices, maybe, and save a lot of the businesses that are being killed by dastardly competition; and if Congress will just do this maybe a lot of men can keep their jobs and get better wages. Of course, your ideas and his don't seem to jibe but this Roosevelt fellow seems to be getting more popular every day and I think you better look him up.

In conclusion, I got a proposition I'd like to make to you. Don't let this get out in Washington or they might start investigating us. I got it figgered out that you probably got lots of dough. Now I'll tell you what let's do. You take a couple of millions of your money and we'll buy a cement plant. I think I know where there's a lot of 'em we could buy mighty cheap because they been losing money for quite a while. Then let's cut the price to beat hell on the Boulder job. Why, we coud make enough on this one job to pay for the plant. These guys that have been running these cement plants for years just don't know how to do it right. What do you say, Mr. Ickes?

Yours for a little of the gravy for ourselves.

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Preparing for Increased Cement Shipments

ANTICIPATING increased shipments as a result of the pending Federal aid construction program, the Huron Portland Cement Co., Detroit, Mich., at Oswego, N. Y., is negotiating with the Lackawana Railroad for immediate construction of a new railroad siding to its packing plant on the Oswego River.

A heavy tonnage of cement now is being shipped from this plant by motor trucks to highway contractors in the vicinity. To supplement this service, officials of the company believe the added rail facilities will be of great advantage as Federal-aid projects get under way.

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U. S. Gypsum Expands

UNITED STATES GYPSUM CO., Chicago, has purchased the McHenry-Millhouse Manufacturing Co., makers of asphalt roofing, South Bend, Ind. The acquisition marks the entry of United States Gypsum into the asphalt roofing business in the central west. Heretofore the company has manufactured and distributed such roofing products only in the Pacific Coast territory. The newly acquired McHenry-Millhouse Company will be operated as a division of the parent company.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Prefabricated Concrete Homes*

By R. E. Copeland, Portland Cement Association

THE subject, "What can the public get in prefabricated homes now?" is one of interesting possibilities both to the general public and to the building profession.

In considering this subject we should appreciate that the expression "prefabricated house" is rather loosely used. I know of only two cases in this country where houses were prefabricated in the literal sense. The houses were quite small. They were built on platforms, trucked to the job and set on the foundations which were prepared in advance. In one case the walls, floors and roof consisted of a light steel frame covered with large sheets of cement asbestos composition. In the other case these elements were of reinforced concrete.

In its broader and more common usage, prefabrication simply means the more complete production of the house before the various members are delivered to the job. With this interpretation in view, hundreds of prefabricated concrete houses already have been built. There is the group of 281 three and four-room homes at Youngstown, Ohio, built for workers in the Youngstown Sheet and Tube Co. mills. These homes rent for about five dollars per month per room. The Humble Oil Co. built 77 concrete homes near Houston, Texas, for their employes. In New York, the Concrete Housing Corp. of America erected nearly 2,000 garages and small cottages, using factory-made concrete slabs for the walls.

This particular type of construction is more commonly known as the precast concrete unit method. Prefabrication is its basic principle, and its entire development has been built around the expected economies theoretically inherent in the prefabrication method.

Briefly, the method consists of manufacturing relatively large concrete sections in a permanent factory or a temporary plant centrally located on the job in case a considerable number of houses are involved. Following the precepts of prefabrication, it is endeavored to make each section as complete or self-sufficient as possible in the factory so as to reduce the amount of labor required for the finishing operations on the job. Structural strength, weather-tightness, durability, fire resistance, finished surfaces and adequate insulation are essential properties, and the ideal process would incorporate these into the finished product at the factory or plant.

Every concrete products manufacturer is concerned with the subject of prefabricated houses. He should have some idea of its influence on his present products to know the possible changes he may find necessary or desirable. The subject is clearly and ably presented herewith. There is much cheer in this story for this industry.

I believe that one thing is certain. If the standardized, factory-made type of home is what the people want and demand we shall see the widespread development of the precast unit method. Factories will be established to serve a local market. No attempt will be made to ship the factory-made sections long distances. There will be no necessity for this as the raw materials are available practically everywhere. Specially designed trailer trucks will answer the transportation problem. The concrete sections will be designed more scientifically to cut down thickness and weight. Lightweight insulating concretes will be used almost exclusively. Surfaces will be finished in color and with rough, smooth or tooled textures to provide a variety in appearance. There is no need for two adjacent houses to look exactly alike, although all architectural plans and dimensions will conform to a common module, the size of the standard section.

At the present time the Portland Cement Association is making a thorough study of this entire problem to find out how concrete can be used more efficiently and economically in home construction. Our efforts in this respect are greatly broadened through our co-operation with the scores of architects, practical builders and others who submit their ideas to us for analysis and constructive criticism.

During the last three-year period the building industry has tuned itself to market demands. It knows far more today about the requirements for decent housing and how to supply them economically than ever before. We are learning how to build better, more durable, fire-resistive homes that please the eye and are easier on the pocketbook. New concrete products and refinements of concrete construction have been developed and placed on the market to the great advantage of the hundreds of thousands of people who will build homes during the coming years.

I should like to describe briefly what I consider typical examples of a new product and new refinements. They are made on high-production machines, save in job labor and result in lower costs.

A typical new product is a precast concrete floor joist. These joists are spaced about 24 in. on center in about the same manner as wood joists are used. They can be readily picked up and carried by two workmen. After the joists are properly spaced, a 2-in. reinforced concrete slab is cast on top to provide the sub-floor. The finish floor may be of any material desired. Little formwork is required. Attractive ceiling effects may be obtained by painting the joists and ceiling slab, thus eliminating the expense of plastering, when desirable.

The upkeep costs and fire losses in homes must be reduced in order to get low-cost housing. The more general use of fire-resistive, rigid floors of the type I have just described will mark an important step toward building more permanent and economical homes. This floor is simple to build and reasonable in cost. It imparts additional strength and security to the entire house and has already been demonstrated successfully in a considerable number of residences.

The refinements have to do with masonry wall construction. In one, which has just been introduced, the masonry unit consists of a hollow block of insulating concrete faced with shallow clay brick. It is made on

*Paper read at Conference on Renewal of Home Building, Chicago, Ill.

a high-production machine and is light enough for rapid laying into the wall yet is equivalent in size to twelve bricks. When compared with the present practices in building masonry walls, it is obvious that this new unit is economical. Other types of facing, such as split stone and colored concrete may be used, affording the architect and home builder a wide variety of facade effects.

Another interesting development is concrete ashlar where units of different sizes are arranged in the wall to give distinctive pattern effects. The surface may be painted or left plain. Painted concrete ashlar is available almost everywhere. It is well suited for both the exterior and interior walls of homes. It is less expensive than most other types of masonry.

Many other new improvements could be named, not only in concrete construction but other materials as well. Therefore, the building industry should not accept without a challenge the rather accusing finger which has been pointed at it because of its seeming lack of initiative and concerted effort in dispelling the cloud of uncertainty and stagnation which prevails in the whole building field at present. It is true, however, that traditional practices must be improved and even cast aside when something else proves better.

In order to meet the present emergency and stimulate a resumption of normal home building our efforts of mutual interest should be integrated and expanded. We must assume more squarely our duty to the public as suppliers of real value in home construction. More attention should be given to the proper interpretation of low costs in housing. It does not necessarily mean the house which is less in original cost but rather the one having the lowest annual charge.

The public should be made to appreciate more fully the excessive waste of impermanent types of housing, the burden of upkeep costs and of fires. We should investigate more thoroughly the long-time economy of more substantial and fire-resistive construction in alleviating these wastes, lowering the annual charges and in eliminating one of the prime factors in early obsolescence in neighborhoods and consequent depreciation in real estate values.

In closing I shall again refer to the prefabricated concrete unit house. Several houses of this type are now being built or are being contemplated. The method has excellent possibilities, whenever the public shows a desire for standardized homes. However, it will be several years at least before a satisfactory economical factory-made house can be made widely available. In the meantime I think we will likely find that there are better solutions to the housing problem than the pre-fabricated house. For the immediate future the prospective home owner should concern himself with the use of the many improved products which are immediately available in any quantities desired. Let the people know of the advantages in using these improved and available products in building better, more permanently and more firesafe. Above all, let them know of the savings they can make by building now instead of one or two years later. Publicity of the right kind will do much toward revitalizing the home-building field. Publicity of the wrong kind creates obstructions, doubts and uncertainties from which we all suffer.

Official Recommendations Covering Concrete Units

THE revised simplified practice recommendation covering concrete building units, is now available in printed form. Copies can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for five cents each, according to the division of simplified practice of the Bureau of Standards.

In the current schedule, which was revised by the standing committee of the industry, the length dimension for three items was changed from the nominal dimension of 12 inches to the actual dimension of 11¾ inches; the maximum permissible variation for block and tile, over and under the given dimensions, was placed at ¼ inch; and in the case of concrete brick, it was decided to follow the tolerances prescribed by the American Society for Testing Materials in connection with clay and sand lime brick masonry units, so that the tolerances of concrete brick will be 1/16 inch in height, ⅛ inch in width, and the standard ¼ inch in length.

Something New in Concrete

HUGO EFFENBERGER, Racine, Wis., announces special cements for particular uses. One of these is for ceramic work, another is colored floors, and a third is for work where light weight concrete is advantageous. The latter is claimed to weigh 50 lbs. per cu. ft. and to be easily cut. Delightful colors have been obtained by Mr. Effenberger in his processed work. It is his intention to license leading concrete products plants to use his materials and processes.

Improved Waterproofing Reduces Cost

AN improved method of processing stearic acid waterproofing paste is announced by Master Builders' Research Laboratories, Cleveland, Ohio, who have perfected a new product which contains two and one-half times the amount of stearate that has been supplied by conventional waterproofing pastes for the past several years. A builder with 10,000 yards of concrete to waterproof has had to use from 9,000 to 12,000 lbs. of the waterproofing pastes that have been widely accepted as standard heretofore to get optimum results.

By using only 3,600 lbs. of the new compound or 3.6 lbs. per cubic yard (.6 lb. per sack of cement) he now introduces the same amount of stearic acid and obtains the same efficiency. Substantial savings in transportation, handling and mixing, are reflected in lower costs.

A further improvement claimed of this improved product is the elimination of ammonia, calcium potassium and other mineral salts that have been employed heretofore in manufacturing stearate pastes. The new product, called Stearox 30, is a straight stearate.

Makers of this product claim that it is absolutely free from adulterants, and guarantee its economy and waterproofing qualities when it is properly used according to specifications.

Group of prefabricated houses recently built near an industrial center. Uniform design of neighboring houses is common, but not essential, in the economical erection of workers' concrete homes

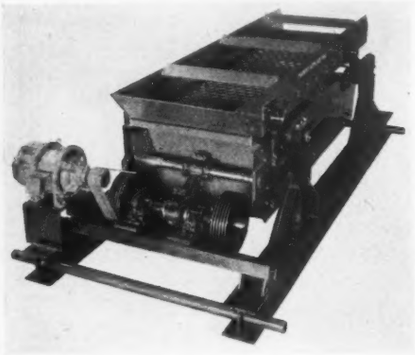
The Malone Concrete Products Co., Malone Junction, N. Y., sustained a fire loss June 9 of $5,000.

Bray Concrete Products Co. has opened its plant in Griffin, Ga.

New Machinery and Equipment

Short-Throw Shaker

DESIGNED for use in screening a wide variety of materials, the new shaker of the Hendrick Manufacturing Co. operates with a short-throw action. Its speed, 250 to 350 r. p. m., is considerably less than that of the average vibrating screen, but is somewhat greater than speed recorded for the general run of shaking screens. There is no vibration to this screen as the decks



Shaker operates horizontally

are balanced and work opposite to each other. The only rotating bearings are on the drive shaft. The other bearings are of the oscillating type, and the movement is so limited that these bearings are equipped with oil-less bronze bushings. The screen is made up in two, three, or four decks, the illustration showing a three-deck screen with a screening surface 3x8 ft.

Expands Screen Business

THE ENTIRE BUSINESS and assets of the Audubon Wire Cloth Co., Inc., wire cloth and wire products manufacturers of Audubon, N. J., were acquired by the Manganese Steel Forge Co., of Philadelphia, Penna., May 1, 1933.

The business will be conducted by the Audubon Wire Cloth Corp., a new organization and wholly-owned subsidiary of the Manganese Steel Forge Co. The officers of the new corporation are: L. W. Jones, president; L. W. Jones, Jr., vice-president and treasurer; A. W. Zackey, secretary.

The heavy wire cloth and wire drawing departments of the Manganese Steel Forge Co., now producers of "Rol-man" manganese steel screens, will augment the Audubon Wire Cloth Corp. facilities. A comprehensive plan of modernization and expansion is already under way involving considerable new equipment.

Products of the corporation include a complete range of wire cloth for industrial, mechanical and commercial requirements in steel and all metals; spiral woven conveying belts for process industries; formed and fabricated wire products; trays and baskets. A specialty department manufacturing strainer assemblies, radio parts and similar products utilizing wire cloth is working on a two-shift basis to meet the sudden spurt in demand of the electric refrigerator, automotive and radio industries.

New Motor Control

EQUIPMENT recently demonstrated by the General Electric Co. to prove the positive effect of vacuum tubes in motor speed control, consists of a 400 h. p. motor and 18 Thyraton tubes. The bank of tubes, receiving its power direct from a 4,000-volt line, converts the power into different frequencies before it is relayed to the motor.

Engineers inspecting vacuum-tube motor control apparatus

Efficiency of this new type of frequency converter is claimed to be 98½%. The tubes perform the function of a commutator. Grid-control makes it possible to start with full torque from standstill, and to operate the motor at any speed without wasting power in resistance.

Hose Seal Perfected

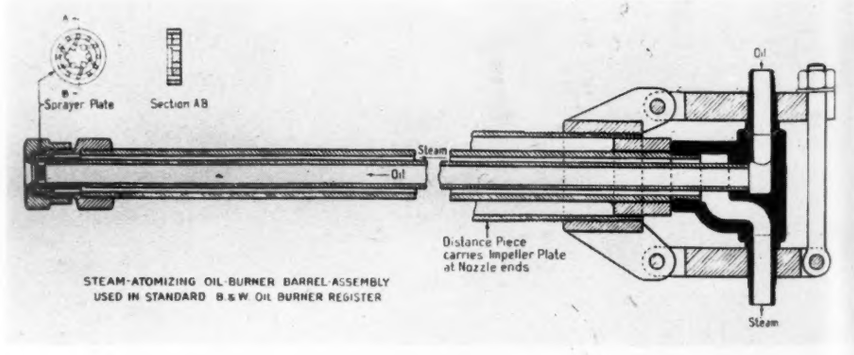
DEFINITE improvement in fire hose manufacture, the "Hydroseal" treatment of cotton jackets, making possible an innovation of a true wax and gum single jacket hose, is announced by The B. F. Goodrich Rubber Co. for both industrial and municipal use. Because of the sealing method used, adhesion of the tube to the jacket is not affected. The manufacturers are also able to thoroughly impregnate the inner jacket of double jacket hose. The seal contains a fungicide chemical which combats mildew.

Engineering Firm

G. F. DODGE and J. E. Searles announce that they have become associated for the practice of mechanical and industrial engineering, specializing among others in sand, gravel and crushed stone operations. Mr. Dodge was formerly with the Robins Conveying Belt Co., and later with the Six companies, contractors for the Boulder Dam. He had much to do with the design of the Boulder Dam sand, gravel and concrete-mixing plants.

Burner for Heavy Oils

IN order to meet the demand for a burner which could handle fuels such as heavy oil, tar, pitch, and acid sludge, when available in quantities, the Babcock & Wilcox Co. has developed the new steam-atomizing burner shown in the diagram. Steam is admitted to the annular space around the central fuel barrel and is projected across each outgoing stream of fuel at the nozzle plate, thus effecting complete atomization and resulting in a short turbulent flame when used with the standard B. & W. Burner Register. A single nozzle plate is used for all capacities from the maximum to minimum ratings, variations in capacity being accomplished by varying the fuel and steam pressures.



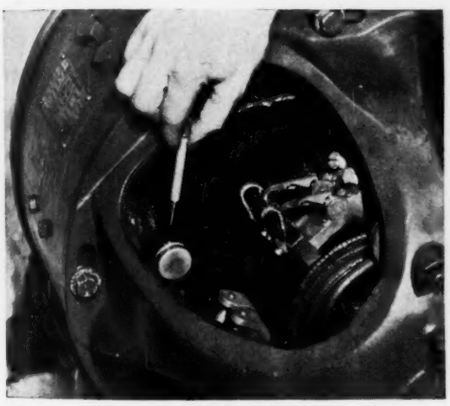
Cross section of oil burner unit

Blasting Cap Package

A NEW packing for individual electric blasting caps, announced by the Atlas Powder Co., Wilmington, Del., offers new features of convenience in handling and use as well as added safety features. The cap itself is the insulated match head type developed by this firm. In this new "Accordion Fold" package the wires are folded accordion-wise and the folds are laid around the blasting cap to protect and cushion it on all sides. This gives extraordinary resistance to external shock. The assembly is placed in a round paper tube. In use the paper tube is broken and the neatly folded wires may be instantly pulled out without danger of kink or snarl. The entire packing is so made that the right way is the easy way to use the accordion fold.

Motors with Thermostats

TO give adequate protection against overheating in industrial motors, the Westinghouse Electric & Manufacturing Co. announces "Thermoguard" motors, having a built-in disc thermostat that functions before the temperature of the insulation reaches the danger point. They may be arranged, at the option of the user, either to be disconnected from the source of power when the temperature approaches the danger zone, or to indicate by giving an audible or visible signal when an unsafe temperature is being approached.



Thermostat-protected direct current industrial motor control mounted on the windings

Roller Bearing Idler

A SIX-INCH IDLER with Timken roller bearings is announced by the Fairfield Engineering Co., Marion, Ohio. These idlers are available in both the troughing and return roller types.

Troughing idlers consist of three pulleys supported by malleable iron brackets and a self cleaning angle base. Pulleys are of the demountable type, all interchangeable. Return rollers are conventional, flat, one-piece with steel supporting brackets.

New clutch-type shovel in action

Excavators

NEW excavators offered by the Marion Steam Shovel Co. are the straight friction, fully convertible type, consisting of a power unit, gas, Diesel, or a single electric motor connected through a master clutch and speed reducing mechanism, directly to the main machinery. Thus, the various functions of hoisting, traveling, swinging, crowding and booming are independently controlled through friction clutches. The crawlers are chain driven and particularly designed for full self cleaning to avoid clogging and its undesirable effects. Besides the two drive sprockets for each crawler, they are provided with intermediate rollers, one for each shoe to prevent the crawler belt from becoming tucked between them.

Insulating Firebrick

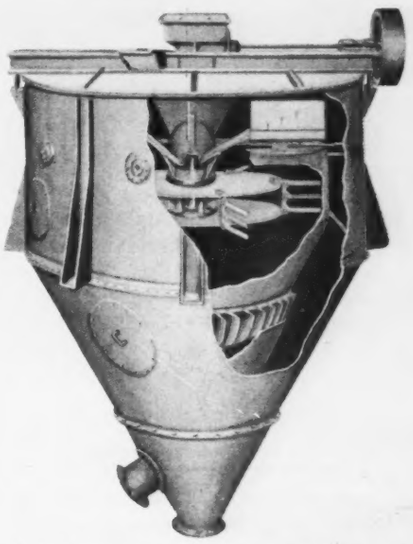
AN INSULATING FIREBRICK, B and W No. 80, is announced by the Babcock and Wilcox Co., New York, N. Y. It is claimed that the new brick not only has improved insulating properties but that it also has refractory characteristics that compare favorably with any high grade fire brick. The brick may be used without a facing of firebrick on the side exposed to furnace gases and temperatures, protected only by a coat of either B and W No. 80 high temperature or patching mortar. The brick weighs 32 lb. per cu. ft. and has a crushing strength of 158 lb. per sq. in.

Improved Centrifugal Pumps

THE Pennsylvania Pump and Compressor Co., Easton, Penn., announces an improvement to its multi-stage centrifugal pumps. This includes a method of maintaining hydraulic balance by arranging impellers so that the suction inlets are opposed to each other. In all pumps, at about the center line of the pumps, two impellers are directly opposed to each other. Balance is then accomplished by proportioning the distance of the bushing between the two directly opposed impellers, the diameter of this bushing being such as to put the rotating element in hydraulic balance. To care for unusual conditions a ball thrust bearing is incorporated in the outboard bearing.

Air Grading Attachment

TO step up the efficiency of air classifiers developed by the Bradley Pulverizer Co., this company now offers a major improvement in its "Turbulators"—to be attached to distributor plates. They not only increase the output of a given size separator, but also produce a finer product without appreciably affecting power consumption. Turbulators, it is claimed, immediately act upon material thrown off the distributor plate by centrifugal action, keeping the material thus thrown off in a constant state of turbulation which tends to dislodge the finer particles from the coarser ones and consequently allowing the air circulation within the separator to pick up the fine particles from the coarser ones.



Attachments for distributor plate of air classifiers

Many Producers Join National Gravel Association

SINCE the National Sand and Gravel Association commenced its program of bringing the sand and gravel industry within the requirements of the National Industrial Recovery Act, new companies, representing every part of the United States, have been added to its membership list. The list of new member companies which joined between June 1 and 16 are:

American Sand and Gravel Co., Hattiesburg, Miss.
Buffalo Gravel Corp., Buffalo, N. Y.
Cape Girardeau Sand Co., Cape Girardeau, Mo.
Carroll Brothers, Inc., Buffalo, N. Y.
Cooley Gravel Co., Chillicothe, Mo.
Curtis & Hill Gravel and Sand Co., Philadelphia, Pa.
Eastern Sand and Gravel Corp., Philadelphia, Pa.
Friend and Company, Inc., Petersburg, Va.
Goodwin-Gallagher Sand and Gravel Corp., New York, N. Y.
Gravel Products Corp., Buffalo, N. Y.
The Hamilton Gravel Co., Hamilton, Ohio
Ideal Sand and Gravel Co., Mason City, Iowa
Oliver King Sand and Lime Co., Knoxville, Tenn.
The Bernard L. McDonald Co., Lawrence, Mass.
Massaponax Sand and Gravel Corp., Fredericksburg, Va.
New London Sand and Gravel Co., New London, Minn.
Pioneer Sand and Gravel Co., Seattle, Wash.
The Putnam Sand and Building Co., Salina, Kan.
The River Sand Co., Topeka, Kan.
Western Massachusetts Sand and Gravel, Inc., Westfield, Mass.

Recent Prices Bid

Cement—Madison, Wis., June 5, bids opened by the Wisconsin Highway Commission on 1,200,000 bbl. of cement to be used in highway construction as soon as the federal government allots Wisconsin the necessary funds, revealed that all of the 13 bidders submitted the same basic price of $1.20 per bbl. Contracts will be awarded on the basis of the service firms can give, their proximity to the projects and like considerations. In taking the bids the commission allowed a 40% increase or deduction in the amount of the cement to be purchased, the exact amount depending on the size of the federal grant. The bidders and the amount for which they bid, in barrels, were: Lehigh Portland Cement Co., 1,200,000; Manitowoc Portland Cement Co., 700,000; Cutler-Magner Co. (dealer) of Duluth, 500,000; Medusa Portland Cement Co., 100,000; Pennsylvania-Dixie Cement Corp., 100,000; Northwestern States Portland Cement Co., 500,000; Marquette Cement Manufacturing Co., 1,200,000; Huron Portland Cement Co., 500,000; Petoskey Portland Cement Co., 250,000; Alpha Portland Cement Co., 500,000; Limestone Products Co. (dealer), 150,000; Dewey Portland Cement Co., 400,000; Universal Atlas Cement Co., 1,200,000. The bids were accepted June 22 for 1,075,000 bbl. The awards were as follows: Manitowoc, 300,000 bbl.; Marquette, 300,000 bbl., including 120,000 over from last year; Alpha, 150,000; Universal, 100,000; Petoskey, 75,000; Dewey, 50,000; Lehigh, 25,000; Huron, 25,000; Northwestern States, 25,000; Limestone Products, 25,000.

Boulder Dam, Nev., on May 18, a combined bid on 400,000 bbl. of cement was offered by the Riverside Cement Co., the California Portland Cement Co., the Southwestern Portland Cement Co., and the Monolith Portland Cement Co., all of southern California. The four companies agreed to supply special low-heating cement at $1.55 per bbl., modified special low-heating cement at $1.42 per bbl. and standard cement at $1.30 per bbl. Their bid on the special low-heating cement was the same as that rejected two weeks previously. The Union Portland Cement Co. of Denver bid on 40,000 bbl. at the rate of $1.55 per bbl., on the special cement, and $1.42 per bbl. on the standard. The bids of the southern California companies are the lowest, inasmuch as the government must pay freight on the cement from the companies' plant to the Boulder Dam. The southern California companies increased the price of their standard cement 6c over that paid by the government when it made its last purchase several months ago. On June 1, Secretary of the Interior Ickes rejected these bids, as he had the previous ones. On June 21 he accepted revised bids at $1.40 per bbl. for the modified standard cement.

Richmond, Va., the Massey Builders Supply Co. awarded contract for supplying the city with cement in quantities as are needed for the ensuing 90-day period. The contract calls for "Volunteer" cement at $3.10 per bbl., less a discount of 10c per bbl. and 10c per bag, or a total discount of 50c in fifteen days, which leaves the net price at $2.60 per bbl. High early strength cement supplied by the contract will cost the city $3.80 per bbl., less a discount of 10c, or $3.70 net. The brand specified is "Incor."

Portland, Ore., identical bids to the city were made for $2.85 a bbl. in carload lots or $3 a bbl. in less than carloads, with credit for sacks, which would make the net price $2.45 in cars and $2.60 in less than cars. Last year the price was $1.78 net.

Milwaukee, Wis., the Froemming corporation and Schneider Fuel & Supply Co. were awarded the contract June 7, jointly, each to furnish the city with 1,500 bbl. as needed the next three months at a cost of $1.84 a bbl. Last season's price was $1.09. Both dealers agreed to accept city orders, payable next February 1, during the time the contracts are in effect.

Sand and Gravel—Milwaukee, Wis., recent bids received by the city for concrete sand, 75c per cu. yd.; gravel, 80c per cu. yd.; cinders, 60, 70 and 90c, in three grades.

Cape May, N. J., contract awarded for 2500 tons of road gravel, delivered on job, 53c per ton.

Crushed Stone—Fostoria, Ohio, stone for repair of county roads, bids $1.05 and $1.07 per ton delivered.

Lime—Piqua, Ohio, bids for 500 tons of lime for waterworks, Marble Cliffs Quarries Co., Columbus, Ohio, $6.40 per ton Grade 1, Scioto Lime & Stone Co., Delaware, Grade 1, $7; Grade 2, $5.75.

Asphalt Coated Stone—Niles, Ohio, Interstate Amesite Co., $5 per ton, f. o. b. plant.

Rock Asphalt—Toledo, Ohio, bids on 10,000 tons, $12.50 to $14.50, on railway sidings in Toledo, $13.50 to $15.90 laid on streets.

Concrete Culvert Tile—Sac City, Iowa, approximately 6345 ft. of concrete culvert tile to Lakeview Concrete Tile Co., Lake View, for $5609.

Cement—The Mississippi Highway Commission awarded ten firms contracts for supplying a million barrels of cement with which to launch Mississippi's $10,000,000 highway construction soon to start. The prices ranged from $2.36 to $2.71 per bbl. f. o. b. to 252 shipping points in the state. The awards were: Alpha Portland Cement Co., 225,000; Hermitage Portland Cement Co., 175,000; Marquette Cement Manufacturing Co., 75,000; National Cement Co., 75,000; Pennsylvania-Dixie Cement Corp., 225,000; Universal Atlas Cement Co., 25,000; Signal Mountain Portland Cement Co., 25,000; Mississippi Portland Cement Co., 25,000 bbl.

Cement News

Illinois ended its price controversy with portland cement manufacturers on June 22 by purchasing 2,000,000 bbl. from the Marquette Cement Manufacturing Co., Oglesby, Ill., at an average delivered price of $1.44 per bbl., or 18c under the $1.62 price previously bid by Illinois and neighboring manufacturers, which was twice rejected by the state.

Nazareth Cement Co., Nazareth, Penn., announces the appointment of Harold B. Robeson, vice-president in charge of sales.

Santa Cruz Portland Cement Co., Santa Cruz, Calif., announces the appointment of Joseph Riordan as superintendent, succeeding Fred Davis, who resigned because of ill health. Mr. Riordan has been assistant superintendent since 1924.

Volunteer Portland Cement Co., Knoxville, Tenn., compromised for $8,820 a $100,000 suit for alleged damages from dust to greenhouses and truck gardens, about one mile away. In a similar suit about a year ago the company is said to have had an adverse decision of $17,500.

To Rebuild Plant

Campbell Stone Co., Afton, Mich., lost a $100,000 lime plant by fire, May 23, within a short time after the plant had started operation following a long shut-down. The loss was covered by insurance and will be rebuilt immediately.

THE INDUSTRY

New Incorporations

Detroit Washed Sand and Gravel Co., Detroit, Mich. To deal in building supplies. Margaret Wank is the incorporator with 100 shares of no par value.

Lobb Construction Co., Pontiac, Ill. Capital stock $10,000. Incorporators are Edward T. Lobb, Hugh Kerans and Orville Johnson. They will engage in the sale of brick, sand, gravel, coal and building materials.

Colfax Stone Co., Colfax, Wis. Two hundred shares common stock, no par value. R. A. Heilman, F. Miles, J. H. Each are the incorporators.

Everett Lime Co., Everett, Wash. Capital stock $10,000. The incorporators are C. C. Clauson, George J. Schuchart Jr. and W. H. Davis.

Round Rock White Lime Co., Round Rock, Tex. Capital $40,000. E. J. and P. A. Walsh are the incorporators.

Hause Gravel Co., Shrewsbury, N. J. The incorporators are Fred Hause, Emma Hause and Doris Crelin.

Concrete Specialties, Inc., Seattle, Wash. Tom W. Holman, E. Dwyer and M. Howisey are the incorporators.

Ormond Corp., Elba, Ark., have filed articles of incorporation with a capital stock of $5,000.

Independent Sand and Gravel Corp., North Hempstead, New York, N. Y., are incorporated for $20,000. To deal in sand and gravel.

Salem Crushed Stone and Sand Corp., Cambridge, N. Y. The incorporators are Gotlieb Keil, Oscar H. Ruiz and Bernice M. Walker.

Milford Traprock Corp., Hopedale, Mass. 1,000 shares $100 each.

Lake Bryan Silica Sand Co., Orlando, Fla., has been incorporated by J. H. Coberly and J. P. Cowart.

Wachusett Trap Rock Co., Holden, Mass. 250 shares at $100 each and 1,000 shares common no par value.

Artisan Stone Corp., Quincy, Mass. 100 shares $5 each.

Durastone Co., Providence, R. I. Capital, 100 shares no par value. To manufacture cast stone. The incorporators are Carl Beretta and Antone Pirovana and Jane Mazzuchelli.

De Soto Kaw River Sand Co., De Soto, Kan. Capital, $10,000.

Valley Lime and Power Co., Seattle, Wash. Capital, $50,000.

Durable Rock Asphalt Co., Leitchfield, Ky. Capital, $50,000. Incorporators are E. V. Browns, B. B. Ochs and O. H. Hershman.

Obituary

Otto Ladwig, 69, president of Otto Ladwig and Sons, Milwaukee, sand, gravel and building materials firm, died May 30 at his home. He came to Wisconsin from Germany in 1864.

Nicholas H. Battjes, 64, founder of the Grand Rapids (Mich.) Gravel Co., died at his home May 28.

William H. Pelkey, 75, ex-congressman and slate quarry owner, died May 14 at his home in Fairhaven, Vt.

Hubert A. Terrill, 23, son of Foreman Terrill of the Muskingum River Gravel Co., Zanesville, O., was drowned May 22.

De Witt C. Estabrook, 83, at one time treasurer of the Moraine City Sand and Gravel Co., died at his residence in Dayton, O., May 20.

Henry Harrison Wilson, 51, Harrisburg, Pa., executive of the Associated Pennsylvania Constructors and president of the Pennsylvania Construction Council, died May 31 at the Johns Hopkins hospital, Baltimore, Md.

G. D. Cope, 20, trapped in a pit of Nelson Rock Crushing plant near Tonasket, Wash., died June 1 before rescue could be effected.

Robert Enloe, 25, caught in a belt of a highway rock crusher near Franklin, N. C., died May 26.

Joseph A. McKellip, 88, died at his home in Baltimore, Md., June 13. He retired as treasurer of the Tidewater Portland Cement Co. seven years ago.

Personals

R. G. Kauffman, of the Southwestern Portland Cement Co., has been elected a vice-president of the Dayton (Ohio) Association of Credit Men.

F. D. Crook, former concrete inspector for the Washington state highway department, has joined the sales division of the Crosby Sand and Gravel Co., Seattle.

E. P. Lucas, president of the Superior Portland Cement Co., Seattle, Wash., interviewed by newspaper men in June, expressed confidence that cement soon will feel the trade impetus already apparent in steel, textile and other industries.

Joseph J. Riordan succeeds Fred Davis, resigning because of ill health, as superintendent of the Santa Cruz (Calif.) Portland Cement Co.

W. S. Speed, president, Louisville (Ky.) Cement Co., was awarded the honorary degree of Doctor of Engineering by the Rose Polytechnic Institute June 10.

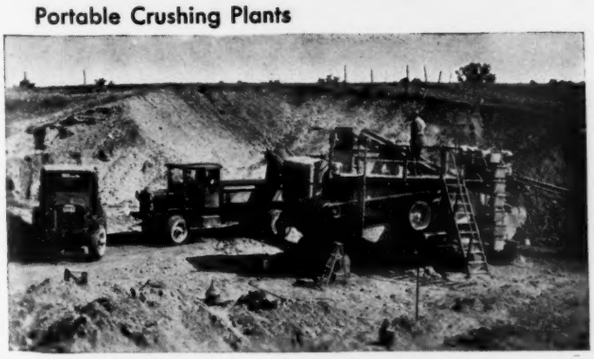
Manufacturers

Link Belt Co., Chicago, Ill., is represented among the many industrial exhibits to be seen at the Chicago Century of Progress ex-

position. This exhibit is located in the Mineral Industries Engineering section of the general exhibits group. The company portrays, by dioramas and translite illustrations, many of the modern methods employed in handling materials mechanically.

Portable Washing Plants

Portable Crushing Plants



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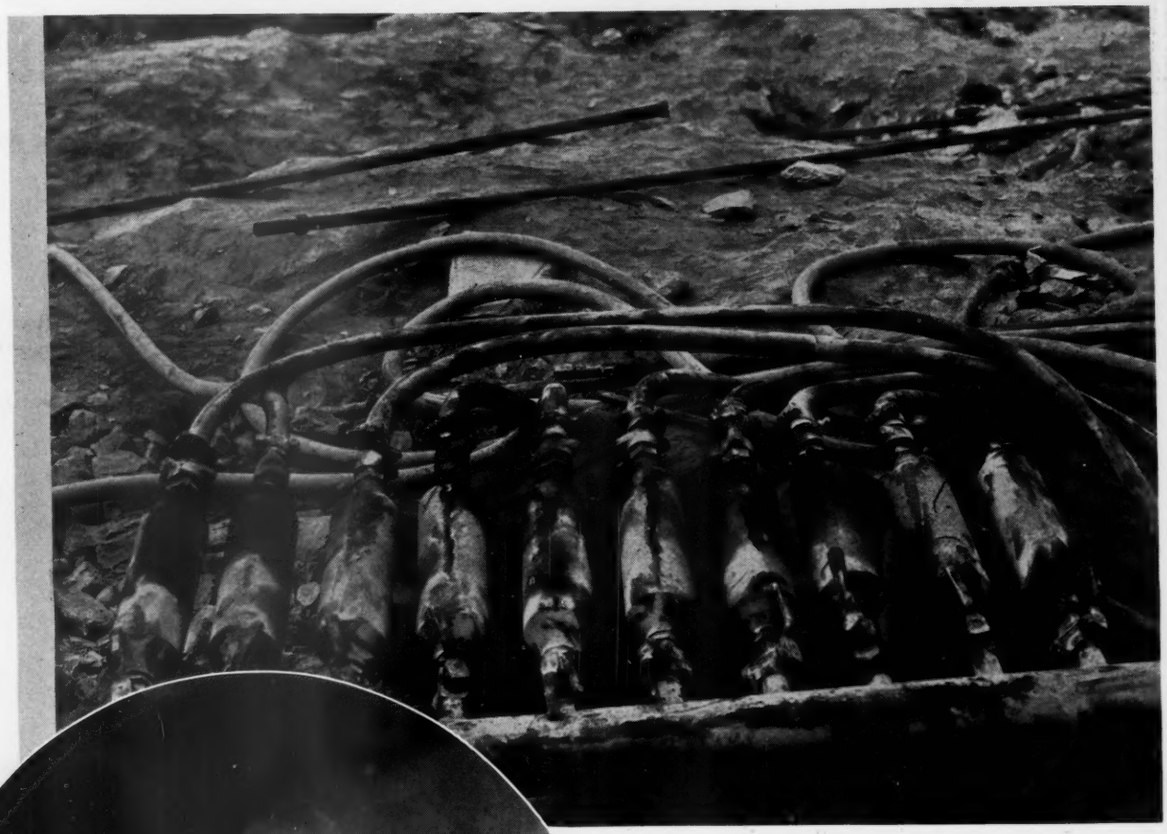
IT TAKES POISON



A ROW OF "POISON BOTTLES"—

poison, that is, to the HOSE. They're life savers to metal, to air tools. For equipment so practical and valuable as the air-line lubricator the right sort of hose just HAD to be developed. Goodrich hose can "take the poison and still live."

LOOK AT THE INSIDE RUBBER

Seems about like any other—black, fairly soft, resilient, full of life, but nothing to distinguish it from other rubber you've seen. The difference is in its chemical makeup. It just REACTS differently to certain treatments; i. e., it isn't SOLUBLE IN OIL!

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Goodrich

SHOVEL OBSOLESCENCE will eat up your profits!

THERE *is* something to be proud of in keeping a "grand old chariot" of a shovel running year ofter year—but pride never payed dividends and "grand old chariots" eat up the profits.

A modern plant won't balance up shovel losses! How about your pit?

How many men operate the shovel? One or three? How long do the cars or trucks wait?

Is the feed to the primaries continuous?

These are but a few of the things that Northwest will check over for you without obligation! We can *show you how to save money* in the pit!

Northwest has a new shovel — a quarry shovel with advantages never before incorporated in shovel design. These advantages mean higher output at lower cost and every quarry operator should know about it. Send the coupon!

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NORTHWEST

will save money for you in the pit!

Rock Products

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July 25, 1933

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